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THE JOURNAL OF PERIODONTOLOGY is published to serve as the professional journal of periodontology; to keep dentists in touch with research being carried on in this field and related sciences; to stimulate greater interest in the supporting tissues of the teeth and their relation to oral and general health.

The Journal is the official organ of the American Academy of Periodontology and will contain, therefore, papers of scientific and clinical interest which are presented at the annual meetings of that society, as well as articles submitted direct to the Editor. Obviously opinions expressed do not necessarily represent those of the Editor or the American Academy of Periodontology.

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FRANK E. BEUBE, L.D.S., D.D.S.

Dr. Frank E. Beube of New York City, New York, is a Councilman of the American Academy of Periodontology and Chairman of the Education Committee of this organization. He also serves as a Director, and is a Diplomate of the American Board of Periodontology.

Dr. Beube is a Canadian by birth and graduated from the University of Toronto Dental School, Toronto, Ontario, Canada, in 1930. Immediately upon graduation he joined the periodontology staff, as a Clinical Assistant, at Columbia University, where he is now Professor and Director of the department. Dr. Beube is also Head of the Department of Periodontology at Presbyterian Hospital in the City of New York, and is a Special Lecturer in the Department of Periodontology of the Graduate School of Medicine, University of Pennsylvania in Philadelphia.

Dr. Beube is a Fellow of the American College of Dentists and the American Association for the Advancement of Science and a member of Omicron Kappa Upsilon, and Sigma Xi, honorary fraternities. He is widely known and respected for his many contributions to dentistry including a text book on Periodontology, several monographs on periodontics, chapters in several books, and numerous articles on periodontal research and dental education. In addition to his academic interests, Dr. Beube is engaged in the practice of periodontics.

THE JOURNAL OF PERIODONTOLOGY

OCTOBER, NINETEEN HUNDRED SIXTY ONE

Gingivoplasty, Gingivectomy, and Osseous Surgery

by JOHN PRICHARD, D.D.S., *Fort Worth, Texas*

ELIMINATION of the periodontal pocket is a prime objective of periodontal therapy, and surgical procedures designed for this purpose are gingivectomy, osteoplasty, and osteoectomy.

The gingivoplasty consists of the plastic reshaping of marginal and interproximal gingiva to recapture good physiologic form and thereby maintain a shallow gingival sulcus. This term and technic should replace the older one of gingivectomy, since it more accurately describes the method and objective. When periodontal disease has advanced so that it cannot be corrected by gingivoplasty because of morphologic aberrations in the underlying bone, osseous surgery is necessary to eliminate the periodontal pocket. The failure can be demonstrated by *probing postoperatively with the same acuity as is done preoperatively.*

The removal of bone in periodontal surgery is not new.[1,2,3,4,5,6] Most of the early reports of osseous surgery indicate that bone was removed because it was believed to be infected or necrotic. Black[7] described the elimination of the interdental bony crater in his original manuscript, "Diseases and Treatment of the Investing Tissues of the Teeth," published in 1915. Carranza[8] published a comprehensive monograph on the "Surgical Treatment of Periodontal Disease" in 1935 in which he described the elimination of shallow infrabony pockets and irregular bone margins by removing small amounts of marginal and crestal bone.

The present interest in periodontal osseous surgery stems from Schluger's classical article published in 1949 in which he set forth the principle of harmonious gingival and osseous architecture for maintenance of pocket elimination after periodontal surgery.[9] Friedman[10] classified periodontal osseous surgery as (1) osteoplasty, the plastic reshaping of bone without the removal of attachment apparatus, and (2) osteoectomy, the plastic reshaping of bone including the removal of bone that is part of the attachment apparatus of the teeth involved. Ochsenbein[11] elaborated on Schluger's original work and described technical improvements in periodontal osseous surgery.

Ideal gingival architecture consists of knife-edged gingival margins which are tightly adapted to the teeth, interdental grooves, and cone-shaped interdental papilla (Fig. 1). Reflection of this gingival tissue will reveal bone of the same

Fig. 1. Adult dentition with ideal gingival architecture. Knife-edged gingival margins which are tightly adapted to the teeth, interdental grooves, and cone-shaped interdental papilla.

Fig. 2. Marginal bone showing the same architectural form as that of ideal gingiva. The interdental cone-shaped bony septa extend beyond the marginal bone occlusally. (From Ochsenbein's "Osseous Resection in Periodontal Surgery," J. Periodont., 29:15-26, January, 1958.)

architectural form. The marginal bone is thin at its junction with the tooth, interdental grooves are usually present, and the interdental cone-shaped bone extends incisal or occlusal to the labial and lingual marginal bone, giving the same scalloped appearance as the gingiva (Fig. 2). This appears to be nature's plan for a healthy periodontium and it can be maintained with reasonable oral hygiene. Therapeutic procedures should attempt to reproduce good architectural form of bone and gingivae.

Gingivoplasty is the surgical reshaping of the gingivae. It is done before periodontal disease causes changes in the bony topography that require correction to secure and maintain a shallow gingival sulcus. Classical indications for gingivoplasty are (1) in cases of altered passive eruption in which the gingiva covers a comparatively large portion of the anatomic crown, (2) where recurrent necrotizing ulcerative gingivitis has altered the gingival architecture, and (3) to eliminate shallow periodontal pockets where bony architectural correction is not necessary.

Figure 3A shows interproximal gingival craters caused by recurrent exacerbations of necrotizing ulcerative gingivitis. These soft tissue craters were eliminated by gingivoplasty.[12] A long beveled incision was made in the gingiva on the buccal and lingual surfaces and the unattached gingival tissue removed. The edge of the knife was then used with a scraping motion to establish interdental grooves and thin gingival margins. Rotary abrasives are excellent for this purpose.[13] The interproximal tissue that was the base of the crater becomes the tip of a gingival papilla (Fig. 3B). The gingivomarginal area now resembles that found in a healthy mouth.

If bone absorption would occur uniformly in periodontitis, maintaining acceptable architectural form, simply shifting apically, it would be a soft tissue problem and a gingivoplasty would eliminate the pockets. However, clinical periodontal pathosis reveals a destruction of the normal bony topography, often with an inverted architectural form. Instead of a bony interdental septum, a crater-like deformity is often found in the interproximal space, as shown in Fig. 4. Another deformity, caused by absorption of marginal bone, is a thick bony ledge marginally; its presence makes the achievement of a shallow periodontal sulcus impossible by gingival surgery.

Periodontal osseous surgery demands a meticulous *resculpturing* of the bony surfaces surrounding the teeth to establish anatomy that resembles the ideal architectural form as much as possible (Fig. 2). Thick bony margins and blunted or flat interproximal bone can be reshaped without removing alveolar bone* proper by

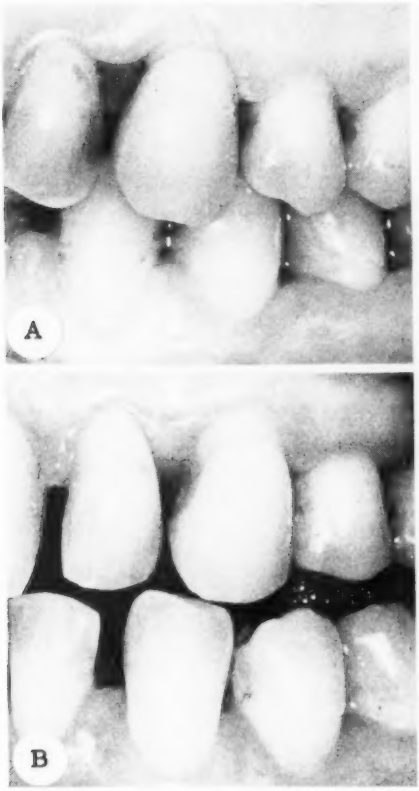

Fig. 3A. Interproximal gingival craters due to destruction of the papilla by recurrent Necrotizing Ulcerative Gingivitis. B. The gingiva after gingivoplasty. Gingival architecture now resembles that of a healthy mouth.

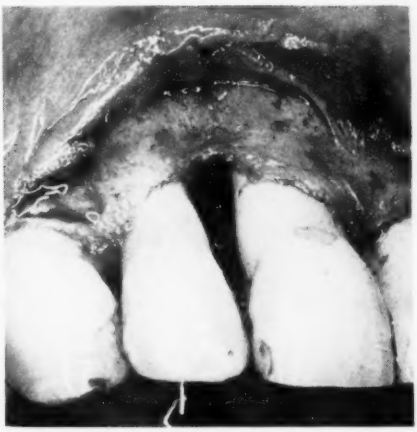

Fig. 4. Interdental bony crater between the right maxillary central and lateral incisors due to periodontitis.

osteoplasty. In Fig. 5A the marginal gingiva has been removed and a mucoperiosteal flap has been reflected, exposing a thick ledge of marginal bone. The bony interdental septa have been absorbed, leaving a flat surface, but craters have not formed. Burs and coarse diamond stones were used under a normal saline spray to reduce this ledge to a thin bony margin. Interdental grooves were established, but the marginal level of bone was not changed (Fig. 5B). Figure 5C shows acceptable gingival architecture six months after osteoplasty.

If craters have developed, some alveolar bone proper must be removed to eliminate the periodontal pocket and establish physiologic architectural form; this is done by osteoectomy which follows the same principle as osteoplasty but includes removal of some alveolar bone proper. Bone removed in these procedures is viable, as is the bone removed to prepare an edentulous ridge as a base for an artificial denture. In the treatment of periodontal disease bone is removed to prepare a foundation for gingiva to rest upon and with which it can be consistent. However, in periodontal surgery it is necessary to remove only a small amount of osseous structure. In Fig. 6A the marginal gingiva has been removed and a mucoperiosteal flap has been reflected, exposing a thick marginal ledge of bone with craters in each interproximal space. Figure 6B shows the vertical reduction of bone to the base of the craters. Alveolar bone proper has not been removed, but if no further osseous reshaping is done, as the gingiva heals, it will bridge the interdental spaces from the marginal bone on the buccal surface of each tooth and interproximal pocket depth will be as great as before treatment. In Fig. 6C some alveolar bone

**Alveolar bone:* the portion of the alveolar process which surrounds the alveoli in maxilla and mandible. (Dorland's American Illustrated Medical Dictionary. 23rd ed. Philadelphia, W. B. Saunders Co., 1957.)

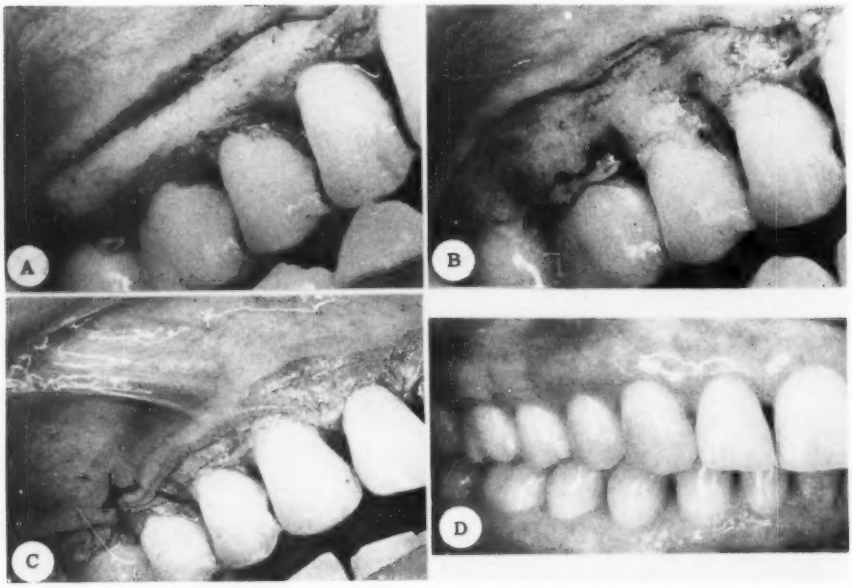

Fig. 5A. Mucoperiosteal flap reflected exposing a thick ledge of marginal bone. The bony interdental septa have absorbed leaving a flat surface. B. After resculpturing by osteoplasty to create thin bony margins and interdental grooves. The vertical level of marginal bone was not altered; alveolar bone was not removed. C. The mucoperiosteal flap is held in place with a suture around the second premolar. The bony margin is not covered with gingiva. D. Gingival architecture six months after osteoplasty.

proper has been removed from the buccal surfaces, slightly reducing the marginal level of bone. The interproximal bone now projects occlusally from the marginal bone, giving the scalloped topography required for physiologic form. Figure 6D shows good architectural form of the gingiva 18 months after the osteoectomy was completed.

When bone absorption is so extreme that enough bone cannot be removed to establish the desired bony architecture without weakening support for the tooth, Schluger's rule of establishing a gradual rise and fall of the bony margin is followed (Fig. 7). In Fig. 7A the bony deformity is exposed and in Fig. 7B osseous reshaping has given a gradual slope to the bony margin that the soft tissue can follow. The bony topography is not anatomically correct, but the deformity is shaped so that soft tissue can follow the bony margin and remain consistent with it. Figure 7C shows the result two years after treatment; sulcus depth is near zero.

Furcation involvements present special problems and usually require the removal of some alveolar bone proper for their correction. Figure 8 shows the management of a mandibular first molar with a bifurcation involvement on the buccal surface. Figure 8A shows the surgical exposure of the bone deformity, B illustrates the vertical grooving in the inter-radicular space and correction of the inconsistent margin. Small amounts of alveolar bone proper have been removed on the buccal, mesial, and distal surfaces, slightly lowering the level of the marginal bone to create good architectural form that can be maintained. The inter-radicular space was contoured in the same manner as an interproximal space in order to create a gingival papilla in the space between the roots. Lingual bifurcation involvements, when present, are managed in the same way.

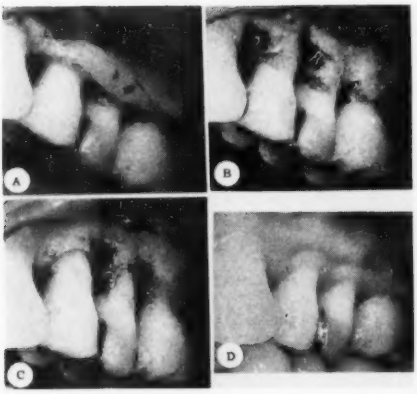

Fig. 6A. Mucoperiosteal flap reflected exposing a thick ledge of marginal bone with deep interdental bony craters. B. The bony marginal ledge has been reduced and the craters have been eliminated by removing their bony wall on the buccal side. Alveolar bone has not been removed. The architectural pattern is inverted, the bony margin extends beyond the septal bone, occlusally. C. After removing small amounts of alveolar and supporting bone on the buccal surfaces of the teeth, the bony architectural pattern resembles that seen in Fig. 2. D. Eighteen months after osteoectomy. Gingival sulcus depth is near zero.

The prognosis usually is favorable for mandibular first molars with bifurcation involvements, because their anatomy usually provides a wide inter-radicular space and adequate vestibular depth. Mandibular second molars with bifurcation involvements usually have a poor long range prognosis because of a narrow inter-radicular space, and their position often is near the mandibular ramus which makes it impossible to provide an adequate zone of attached gingiva or sufficient vestibular depth.

Trifurcation involvements from the buccal surface of maxillary molars are managed in the same manner as bifurcation involvements of mandibular molars. The trifurcation of maxillary molars is often involved from the mesial surface and, in this case, osseous reshaping is done from the mesial-lingual aspect to eliminate the deformity.[14] The prognosis for maxillary molars with trifurcation involvements from the buccal or mesial surface is usually

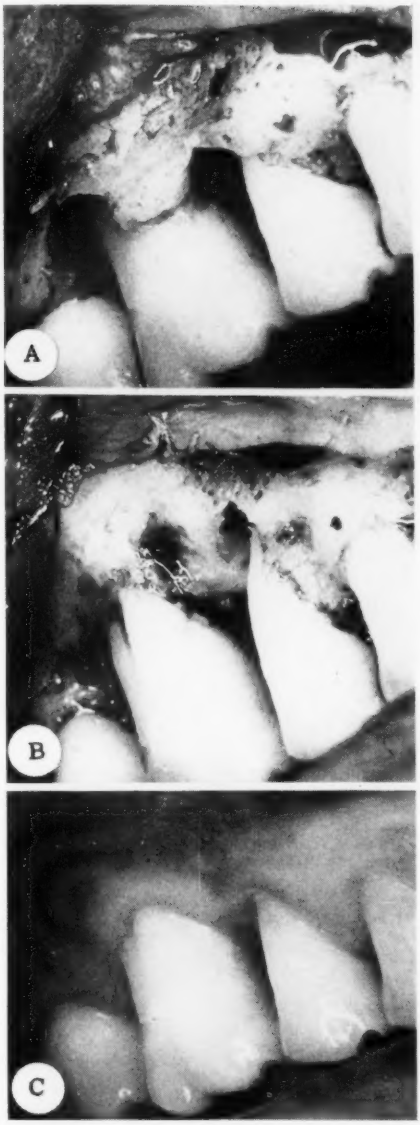

Fig. 7A. Mucoperiosteal flap reflected exposing bony deformity. Ideal bony architecture cannot be created without weakening support for the adjoining teeth. B. After osteoectomy, the bony topography is not anatomic, but the deformity is shaped so that soft tissue can follow the bony margin and remain consistent with it. The deformity on the buccal surface of the second premolar has three bony walls and should be eliminated by a regeneration of bone. C. Two years after osteoectomy. Gingival sulcus depth is near zero.

favorable; from the distal aspect prognosis is generally unfavorable. However, if the tooth involved is the terminal one in the arch and the anatomy of the region is such that elimination of the bony deformity is possible, prognosis may be favorable. In these cases bone is still present in the interfurca and an instrument cannot pass from one surface to another through the furcation.

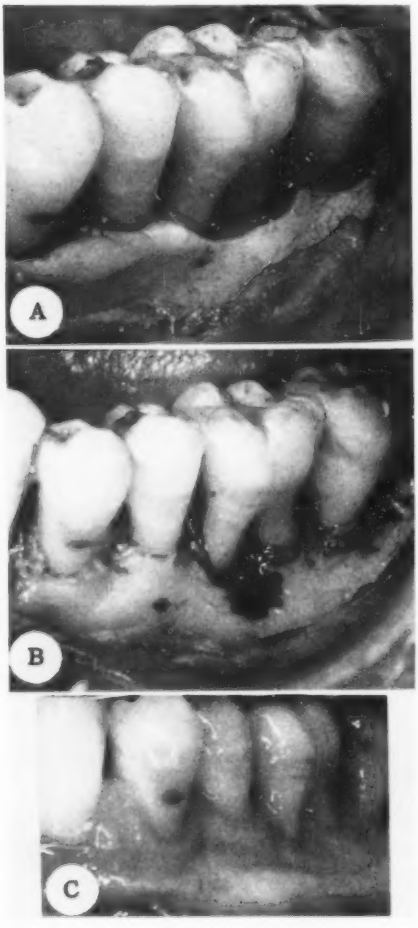

Fig. 8A. Mucoperiosteal flap reflected exposing inconsistent bony margin with bifurcation involvement. B. After osteoectomy. C. Anatomic gingival architecture six months after osteoectomy. There is a gingival papilla in the furcation.

Endodontic therapy is sometimes employed, making it possible to save one or two roots of a molar that has a hopeless prognosis because of furcation involvement. Figure 9 shows a lower molar with a bifurcation involvement extending through the furca from the buccal aspect to the lingual surface. The tooth was divided through the furca with an edge-cutting disk and the mesial root was removed. This changed the bony topography

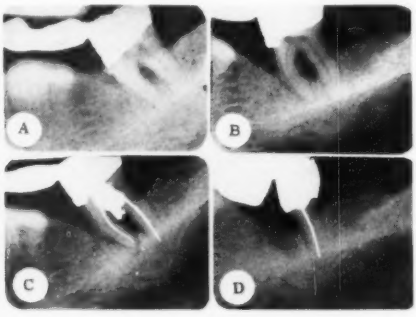

Fig. 9. Roentgenograms of a mandibular second molar with a bifurcation involvement. Upper left, before treatment. Upper right, one year after osteoectomy. Lower left, during endodontic therapy two years later. The opaque material in the furca is zinc oxide. Lower right, 12 months after the mesial root was removed. (Endodontia courtesy of Dr. Peter Simon and fixed prosthesis courtesy of Dr. J. S. Morris).

from an unfavorable bifurcation involvement to a favorable intrabony deformity on the mesial surface of the remaining root. A fixed prosthesis was constructed using this root as the distal abutment.

Endodontic procedures may also be employed without root extraction with pulpal involvement from root caries which sometimes complicate these cases.

Infrabony pockets with one, two, or three osseous walls of various levels occur frequently in the interproximal region but may be found wherever bone is thick enough to have trabecular bone between the tooth and the cortical plate. Osseous surgery usually is done to eliminate the deformities with one and two osseous walls. The same technique is used when three

Fig. 10. Roentgenograms of mandibular molar. Above: broad, shallow intrabony deformity that is not favorable for the intrabony technic. Below: 18 months after osteoectomy to eliminate the deformity.

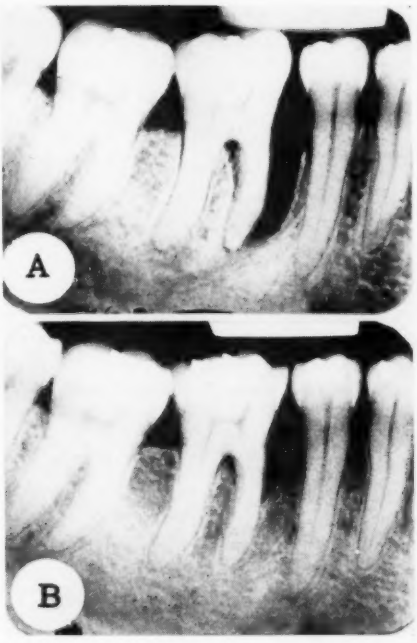

Fig. 11. Roentgenograms of mandibular molar with deep intrabony deformity. Above: before treatment. Below: 30 months after intrabony therapy.

osseous walls are present, if the deformity is broad and shallow (Fig. 10). Deep, narrow infrabony deformities with three osseous walls (intrabony) surrounding the tooth root usually can be eliminated by a regeneration of periodontium, that is, bone, periodontal ligament, and cementum in the absorbed area.[15] Figure 11 illustrates a typical case.

SUMMARY

Elimination of the periodontal pocket is a prime objective of periodontal therapy, and physiologic gingival architecture is essential to obtain this objective. Normally the gingiva is consistent with the underlying bone, and aberrations in gingival form can be corrected by gingivoplasty if the gingiva is supported by good bony architecture.

If periodontitis has caused marginal irregularities or septal deformities, osseous reshaping is done by osteoplasty or osteoectomy. Infrabony deformities are eliminated by osteoectomy or by a regeneration of new periodontium to fill the defect or by a combination of both techniques, depending upon the topography of the bony deformity.

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DR. MERRITT BEQUEATHS $5,000 TO AMERICAN ACADEMY OF PERIODONTOLOGY

During his long and exemplary career, Dr. Arthur H. Merritt always supported the American Academy of Periodontology, so it was not surprising that he bequeathed $5,000 to the American Academy of Periodontology. Since among his favorite projects was dental journalism and the Journal of Periodontology, the Editor assumes at least some of this money can be used to improve this publication.

Dr. Merritt wrote in his will . . . "my intention and purpose, to the extent that any such residue shall remain, is to dedicate for charitable uses as a voluntary payment of the debt that I owe society for the opportunities, the privileges and the blessings which have come to me as a citizen and resident of the United States of America, an adherent of the Christian faith and a member of the dental profession. My Trustees know, and this Will in a measure shows, my interest in the profession of dentistry, to which more than sixty-five years of my life have been devoted, and in the maintenance among members of the profession of standards of integrity and dedication, and of my interest in the advancement of learning and in the enrichment of the spiritual life. . . ."

Dr. Merritt also gave other grants to dental organizations, including $5,000 to the American Dental Association. It is to be hoped others will be inspired to follow Dr. Merritt's commendable example.

Technique for the Stabilization of Tissue Flaps Employing Chrome-Cobalt Alloy Tissue Tacks*

by JAY S. SEIBERT, D.D.S., M.S.D.,** *Dallas, Texas*

THERE are at present many surgical techniques available to aid the clinician in coping with periodontal problems that involve malrelationships of the mucogingival complex of tissues. A gingival flap is raised in most of the techinques currently advocated to allow access for osseous recontouring, root planing of the teeth, and plastic repositioning of the attached gingiva and mucogingival junction. The aim of all of the techniques is to eliminate periodontal pockets extending to, or beyond, the mucogingival junction and to establish a zone of attached gingiva in the healed case that is: 1) scalloped or 'physiologic' in contour; 2) of ample width to withstand the forces of mastication and oral physiotherapy procedures; 3) free from the tension of frena and broad muscle insertions, and 4) in a 'normal' relationship to the vestibular fornix.

Management of the soft tissue flap created during surgery is a problem that has plagued many clinicians using the various techniques for mucogingival surgery. The problem areas usually encountered are:

1) The flap is pulled apically by muscle tension thereby exposing more bone than desired and creating a zone of attached gingiva that is wider than necessary or normal for the area involved. In the anterior regions of the mouth this may create esthetic problems.

2) Tension and movement on the margins of the wound delay connective tissue healing.[1] This tension in a lateral direction may create unwanted pouching of the tissues. The pouches so created fill in with dense fibrous connective tissue and negate the efforts expended during surgery to create the desired sluiceways and contours in the soft tissues.[2]

3) The flap must be maintained in an apical position in intimate contact with the bone in order to broaden the zone of attached gingiva and to establish the new mucogingival junction at a more apical level. This condition is the opposite of the first problem cited where the flap must be maintained in a coronal relationship against the pull of the surrounding musculature.

Various methods have been offered for stabilization of the soft tissue flap. Nabers,[3,4] who originated the technique for repositioning the attached gingiva, used sutures and periodontal dressing to stabilize the surgically created flap. Ariaudo and Tyrrell[5] relied upon the fibrin of the clot to maintain the flap in the desired position. In their earlier work they covered the flap with adhesive foil to keep the dressing from displacing the flap. In more difficult cases they used sutures or a compound stent to help hold the flap in position. In a later paper, Ariaudo and Tyrrell[2] advocated two methods of suturing to prevent displacement of the flap and maintain the desired soft tissue relationships. They suggested a suspension suture placed around a tooth in the area to prevent apical displacement of the flap. To prevent occlusal displacement, they suggested the use of mattress

*Summary of a Thesis submitted to the Faculty of Baylor University in partial fulfillment of the requirements for the Degree of Master of Science in Dentistry.

**Captain, DC, USA. Resident in Periodontology, Brooke General Hospital-Baylor University College of Dentistry, 1959-61. Present address: Dental Services Detachment, Fort Dix, New Jersey.

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Department of the Army or the Army Dental Corps.

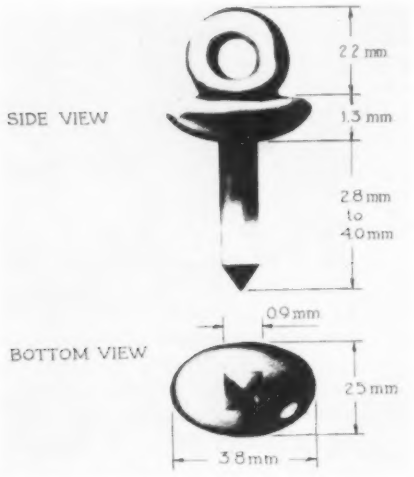

Fig. 1. Design of tissue tack which is cast with chrome cobalt alloy. Dimensions are approximate and shown in millimeters.

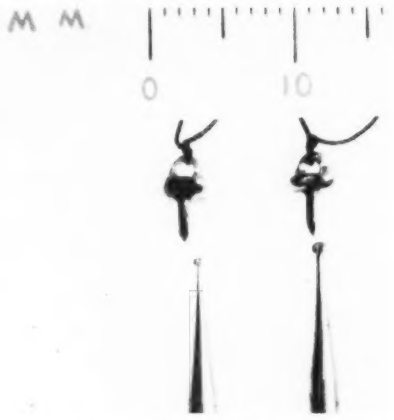

Fig. 2. Tissue tacks shown with metric scale. Round burs, #½ and #2, shown with tissue tacks for comparison of bur sizes to the width of the shaft of the tissue tacks.

sutures to suture the attached gingiva to the periosteum. They also pointed out the need for V-shaped relaxing incisions which allow the dressing to maintain the flap against the undulating contours of the bone. Many clinicians have used plastic stents in one form or another to aid in maintaining the position of the flap.

The various methods offered for control of the flap in the postsurgical state leave something to be desired in the way of positive control over the final position of the flap. This is especially the case where the problem is to maintain the tissue in an apical position, against the forces tending to push the flap in an occlusal direction, and in close contact with the bone in the interproximal sluiceways and ramped bifurcation areas. The use of a chrome-cobalt alloy tack, or pin, to tack the gingival flap to the alveolar bone appeared to be a suggestion* worth investigating in our quest for better control of the repositioned tissue at surgery.

A clinical experiment was designed to test feasibility of using chrome-cobalt tissue tacks to stabilize the soft tissue flap created during repositioning of the attached gingiva.[6,7] The tissue tacks were to be evaluated from two aspects, the biological and mechanical. To be considered a useful adjunct to our therapeutic procedures, the tissue tacks would have to be completely tissue acceptable while satisfying the mechanical requirements for stabilization of the soft tissue flap. Four criteria were selected for use in assessing the results of the clinical testing: 1) ability of the tissue tacks to maintain the position of the flap; 2) patient reaction to the procedure; 3) gross tissue reaction to the presence of the tacks; and, 4) the rate of healing based upon clinical observation. In attempting a pilot study such as this, broad and objective measurements were desired so that the results could be quickly evaluated. Miniature tissue tacks were designed (Fig. 1, 2), cast in Ticonium, and made ready for testing. Seventeen patients participated in the experiment during which a total of 38 tissue tacks were used.

The sequence of operation using the tissue tack technique is illustrated diagrammatically in Figure 3. The repositioning path of incision[1] is used with this technique

*Suggestion made by Dr. B. Orban to Dr. C. L. Nabers. Related to author in personal communication with Dr. C. L. Nabers.

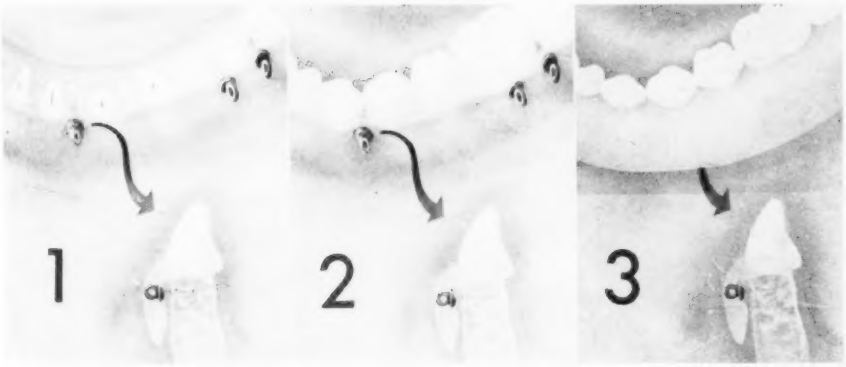

Fig. 3. Illustration of Technique. Step 1 shows the position of the tissue tacks in relation to the roots of the teeth. For diagrammatical purposes, the teeth are illustrated with the crowns removed. Note that a tissue tack has been placed between the roots of the first molar. Step 2 shows the margin of the flap stabilized in the desired position and ready to receive the periodontal dressing. Cross sectional view shows head of tack embedded in the dressing. Step 3 shows the completed quadrant of surgery which has been covered with the periodontal dressing.

(Fig. 4). After the necessary osseous recontouring and root planing of the teeth has been accomplished and the wound is ready for closure, the flap is brought to the desired position against the bone. While holding the flap in position with finger pressure, the surgeon notes the places where it will be most desirable to tack the flap to the bone. The cortical layer of the alveolar bone is extremely dense and hard. In order to insert the tissue tack in the desired location, a guide hole is drilled into the bone. The tissue tack can then be pushed into the hole, using serrated-beak pliers to grasp the tack, without a great deal of force being used. A #½ round bur is slightly smaller than the shaft of the tissue tack, and is used for making the guide hole. While holding the flap in place, the handpiece and bur are brought into position directly over the site where the tack is to be placed. The tissue is then pushed apically out of the way and the bur is brought into contact with the bone. The angulation of the bur to the roots of the teeth and to the surface of the bone is carefully checked before drilling into the bone. Full mouth X-rays of diagnostic quality are necessary when using this technique. When operating on the maxillary arch the alveolar extensions of the maxillary sinus must be determined to avoid the possibility of an accidental penetration into the sinus. Figure 5 shows the extent the tissue tacks penetrate the bone.

After the cortical plate of bone is drilled with the bur, the tack to be used is gently fitted into the guide hole. If the hole seems too tight the opening is enlarged slightly with the bur. The area is flushed with isotonic saline solution and checked for removal of all debris before bringing the flap back into position. The tack is grasped firmly in the beaks of the pliers and forced carefully through the middle of the zone of attached gingiva directly over the guide hole made in the bone. This tissue is tough and fibrotic and will not tear as the shaft of the tack pierces the tissue. The guide hole can be felt with the tip of the tack. The tack is then pushed into the guide hole. The head of the tack will draw the tissue against the bone. The tack is inserted deep enough so that the immediate surrounding tissue will be *slightly* blanched. Heavy pressure is not desired or needed for any part of this technique.

The procedure is repeated with other tacks in a similar manner as often as is necessary to stabilize the flap in the desired position. At times the flap will be drawn too tightly across the bone because the

Fig. 4. Diagram of the repositioning path of incision.

Fig. 5. Radiograph of mandible, Case #15. Film taken 7 days postoperatively after the dressing was removed. Four tissue tacks were used on this case. The distal tack was removed with the dressing and is not shown in the radiograph. The depth the tissue tacks are placed into the cancellous bone can be determined from this film.

linear distance of the area to be covered has been increased as a result of contouring the underlying bone. The tissue tacks will adapt the flap to the depths of the concave interproximal and interradicular areas. If relaxing vertical incisions are necessary they are made over the height of contour on the buccal surface. It is better to make several small incisions than one large one. The V-shaped areas so created will be smaller and will expose less bone (Fig. 8-b).

The area of operation is covered with a periodontal dressing upon completion of the tacking procedure. The dressing is mixed to a fairly stiff consistency to aid in maintaining the tissues of the vestibule in the desired position. The dressing surrounds the heads of the tacks and covers them completely. The tissue tacks are removed at the first dressing change. After removal of the tacks and irrigation of the area, the site of surgery is again covered with the periodontal dressing until healing has progressed sufficiently to leave the wound uncovered.

As experience was gained in the use of the tissue tacks, an added safety precaution was incorporated into the technique. A length of 4-0 suture silk is now knotted

Fig. 6. Case #2. A, Preoperative photograph—probe in two-walled osseous crater. B, Surgery completed and tissue tacks in position. C, 60 days postoperative. Operative dentistry completed.

to the ring of the tack. The tissue tacks are autoclaved with the suture already fastened to the tacks. After placement of the tissue tack, the suture is looped about a tooth in the area and the knot is tied on the lingual surface of the tooth. While no tissue tacks have worked loose to date, in case of accidental loss of the dressing the tissue tacks would not be swallowed or aspirated before the patient could return for an emergency dressing change. At the first dressing change, the lingual portion of the dressing is removed first so that the knot can be cut allowing the buccal portion of the dressing and the tissue tacks to be withdrawn.

The periodontal dressing will usually flow through the ring of the tissue tack embedding the head of the tack within the hardened dressing. A reciprocal action is thereby obtained. The dressing aids in holding the tacks in position, while at the same time the tacks help to stabilize the dressing. As a rule, when the dressing is changed for the first time the tacks are found to be solidly positioned in the bone. To aid in the removal of the dressing, it has been found advisable to score the dressing over the heads of the tacks with a sharp instrument so that the dressing will fracture leaving the tacks in position. The tacks are then withdrawn with serrated-beak pliers. The entire procedure produces no more discomfort to the patient than an ordinary dressing change.

When the patient returns for the second dressing change five to seven days later, it is usually quite difficult to locate the area where the tissue tacks were placed. In two cases a residual fistula was noted over the area where a tissue tack was withdrawn at the previous visit. This was attributed to the lack of any spontaneous hemorrhage at the time the tissue tacks were removed. These areas were freshened with a sterile curette to promote hemorrhage and were

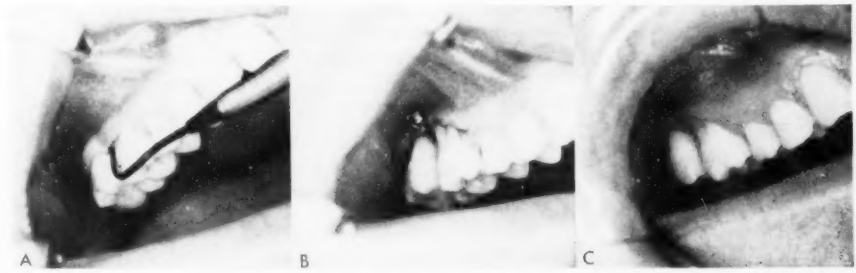

Fig 7. Case #3. A, Preoperative photograph. Two-walled osseous defect between molars with a normal crevice depth about remainder of teeth. B, Surgery completed and flap tacked in position ready for dressing. C, Photograph 10 weeks postsurgery.

Fig 8. Case #14. A, Repositioning incision made and flap retracted exposing the osseous craters. There is incipient bifurcation involvement of first and second molars. Third molar to be extracted. Extensive overhang of amalgam present on cervical restoration. Note ledges of calculus. Patient 23 years old and in good health. B, Tissue tacks in position. The anterior and posterior tacks have been placed into the bifurcation areas of the first and second molars. Center tack is in the interproximal area. Note V-shaped relaxing incision. C, Photograph, 6 months postoperative.

redressed after a clot had formed. These areas were completely healed by the next dressing change. The procedure of producing a slight hemorrhage from the site of tack placement has been incorporated as a routine part of the technique. By adding this step to the technique the occurrence of residual fistula-like areas has been eliminated.

Since the tissue tacks open a tract from the contaminated oral cavity into the marrow spaces of the bone, the use of prophylactic antibiotic medication is considered necessary. No infection was noted in any of the cases in which the tissue tacks were used. Roentgenograms taken sixty days after surgery show normal healing and no trace of tack placement.

The tissue tacks succeeded in maintaining the flap in close contact with the bone regardless of whether the problem was to maintain the flap occlusally or to depress it apically. In eleven of the seventeen cases operated, the rate of healing was considerably accelerated. This determination was made by comparing the area operated with the other side of the arch operated in a similar manner but not stabilized with tissue tacks, or to other cases that were of a similar nature and extent of involvement but stabilized only with sutures and periodontal dressing. The increased rate of healing was attributed to : 1) the accurate and close adaptation of the soft tissue to the bone thereby eliminating voids or pouch-like defects that must fill in with a fibrin clot and granulation tissue, and; 2) stabilization of the wound preventing movement and gaping of the wound margin.

Three cases from the experiment are illustrated to show the placement of tissue tacks in the maxillary anterior area (Fig 6), maxillary posterior area (Fig. 7), and in the mandibular posterior areas of the mouth (Fig. 8).

CONCLUSIONS

1. The concept of tacking the soft tissue to the alveolar bone appears to be a biologically and mechanically acceptable procedure.

2. In cases where positioning and stabilizing of the soft tissue flap normally would have posed problems, the tissue tacks succeeded in maintaining the soft tissue flap in the desired relationship to the surrounding hard and soft tissues. The tissue tacks proved to be especially valuable in adapting the soft tissue to the contours of the bone where the bone was markedly contoured for interproximal sluiceways or ramped for bifurcation areas.

3. This technique was well tolerated by the patients, and in most instances they were not aware that anything out of the ordinary was done to them when they submitted to the use of a 'new type of suture.'

4. While the number of patients used in this pilot study was of necessity small, the apparent biological and mechanical acceptability of the procedure indicates a need for further investigation into this concept of management of the soft tissue flap.

5. Coaptation and stabilization of the surgical wound accelerated the rate of healing in eleven of the seventeen cases operated. When used as outlined in this paper, the tissue tacks afford the periodontal surgeon an efficient and effective method for coping with problems of difficult tissue management incurred during repositioning of the attached gingiva.

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NORTHEASTERN SOCIETY OF PERIODONTISTS TO GIVE BERNARD GOTTLIEB PRIZE

The Northeastern Society of Periodontists has established a Bernard Gottlieb Prize consisting of a $200 cash award and a certificate, to be awarded at their annual spring meeting. The prize will be given for the most outstanding original investigation in the field of periodontics which is submitted for the contest. Papers must be in the hands of the Secretary, Northeastern Society of Periodontists, prior to January 1 of the year of award.

For additional details please write Dr. I. W. Scopp, Secretary, Northeastern Society of Periodontists, Veterans Administration Hospital, New York 10, New York.

The Effect of Increased Functional Forces Upon the Periodontium of Splinted and Non-Splinted Teeth*,**

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Boston, Massachusetts

ATTEMPTS have been made to explain the distribution of occlusal forces among teeth in fixed splints on a theoretical basis,[1] but the tissue changes in the periodontium of splinted teeth have not been described. The periodontal tissue changes induced by excessive occlusal forces on individual teeth are extensively documented.[2-5] We felt that such tissue changes could be utilized as a tracer to determine distribution of occlusal forces among teeth united in a fixed splint. An experiment was conducted for the purpose of comparing the transmission of occlusal forces among splinted and non-splinted teeth.

EXPERIMENTAL PROCEDURE

Five adult rhesus monkeys were used as experimental animals, one of which served as a control.

In animal I, four gold crowns joined together to form a fixed splint were cemented on the first and second mandibular premolars and first and second molars on the right side. The splint was constructed so that it did not interfere with the normal occlusal relationships of the dentition. On the maxilla on the right side, a gold crown was constructed for the second molar so that it extended beyond the line of occlusion and contacted only the second molar in the mandibular splint. (Fig. 1.) The remaining teeth in both arches were out of contact. An excessive mesio-apical force was thereby created on the mandibular right second molar with a reciprocal disto-apical force on the maxillary second molar. Animal I was sacrificed after 10 days.

In animal II, similar restorations were inserted so as to create a comparable change in the occlusal relationship. Animal II was sacrificed after 92 days.

In animals III and IV gold crowns were cemented on the mandibular right first molars. The crowns were constructed so as to open the bite and create excessive occlusal forces upon the maxillary second premolar (animal III) and the maxillary second premolar and first molar (animal IV). The experimental periods were of 21 days (animal III) and 132 days (animal IV) duration.

At the termination of the experimental periods, the animals were sacrificed, the jaws were fixed in formalin, decalcified in an equal mixture of formic acid and sodium citrate, embedded in celloidin and cut in serial sections.

GROSS OBSERVATIONS

At time of sacrifice the amount of bite opening created by the prosthesis was only slightly reduced in the short term animals (10 and 21 days). In the long term animals (92 and 132 days) complete closure of the jaws was reestablished.

Animal I, Short term splint, 10 days: Severe destructive changes were observed in the bifurcation area of the mandibular second molar. This was the most distal tooth in the splint and the only tooth in contact with the maxilla (Fig. 2). At the crest of the interradicular bone and along the lateral aspect adjacent to the distal root the periodontal membrane was compressed and necrotic (Figs. 3 and 4). Necrotic fragments of bone surrounded by osteoclasts were present in the periodontal membrane space (Fig. 5). The cementum presented isolated resorption concavities. In relation to the distal surface of the mesial root, the periodontal membrane fibers were well-formed and distended. New cementum was formed on the root and new bone formation was observed on the adjacent bone surface. The findings were consistent with those produced by an excessive force

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Fig. 1. Animal I at time of insertion of appliances showing the mandibular splint and crowned maxillary second molar. The amount of bite opening can be seen in the anterior region.

in a mesio-apical direction.

In the interdental areas mesial and distal to the mandibular second molar there was slight accentuation in the normal compression (mesial) and widening (distal) of the periodontal membrane (Fig. 6). No notable changes were observed in the bone or tooth surfaces.

Destructive changes similar in nature and distribution to those in the periodontium of the second molar were observed in the interradicular areas of the other teeth in the splint, the first molar (Fig. 7) and the first and second premolars. At the apices of the premolars, the periodontal membrane was widened and increased in cellularity and vascularity and the adjacent surfaces of the root and bone were resorbed. New bone was laid down reinforcing the trabeculae thinned by resorption (Figs. 8 and 9).

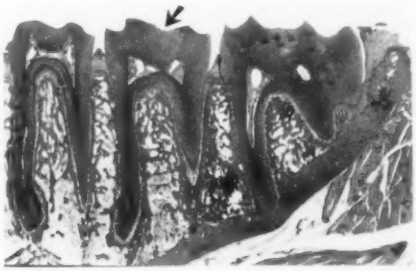

Fig. 2. Survey mesio-distal section of mandibular right first, second and third molars. Arrow indicates direction of occlusal force. Hematoxylin and Eosin. Orig. Mag. X3.5.

No appreciable changes were observed in the periodontium of the mandibular third molar which was not included in the splint.

There were large accumulations of calculus in the interproximal areas between the splinted mandibular teeth. The interdental gingival papillae were inflamed. The gingival epithelium was slightly hyperplastic and presented varying degrees of degeneration. There was no pathological pocket formation or migration of the epithelial attachment along the root surfaces of the splinted teeth.

The crowned maxillary right second molar which was the only maxillary tooth in occlusal contact was depressed in its socket in a disto-apical direction (Fig. 10). Severe destructive changes occurred in the periodontium in the bifurcation, apical, and the mesial and distal interdental areas. In the bifurcation area the periodontal mem-

Fig. 3. Low power mesio-distal section of the bifurcation area of the splinted mandibular second molar. Note the necrosis of the periodontal membrane and resorption of the alveolar bone at the crest. The arrow indicates the direction of the occlusal force. Hematoxylin and Eosin. Orig. Mag. X50.

brane at the crest was crushed and necrotic and the tooth was in contact and with the bone. There was osteoclastic resorption of the necrotic bone. There were areas of partially repaired resorption of the root surface.

In the apical areas the periodontal membrane was crushed and there was necrosis and resorption of bone between the root and the floor of the sinus (Fig. 11). The opposite surfaces of the resorbed bone trabeculae were reinforced with new bone. The root apices were resorbed and partially repaired.

On the mesial and distal surfaces of the maxillary right second molar the periodontal membrane was compressed and in some areas was necrotic (Fig. 12). The alveolar bone adjacent to the latter areas was also necrotic. There was osteoclastic resorption of the bone in the areas where the periodontal membrane was compressed.

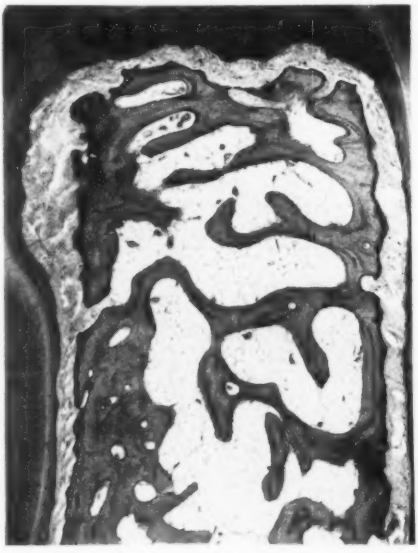

Fig. 4. Low power mesio-distal section of the bifurcation area of mandibular second molar in control animal. Compare with Fig. 3. Hematoxylin and Eosin. Orig. Mag. X35.

Fig. 5. High power study of distal aspect of the interradicular alveolar crest of the splinted mandibular second molar shown in Fig. 3. Note the necrosis of the periodontal membrane and osteoclastic resorption of the alveolar bone. Hematoxylin and Eosin. Orig. Mag. X160.

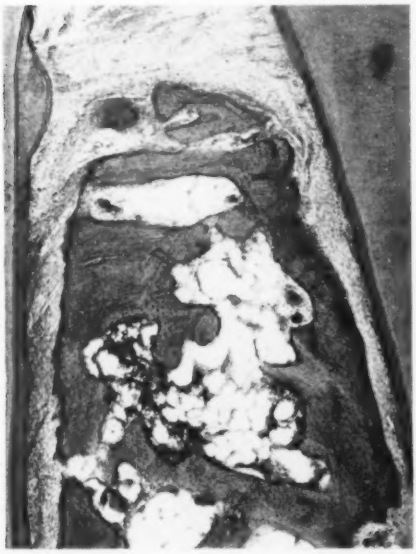

Fig. 6. Mesio-distal section through interdental bone between the splinted mandibular first molar (left) and second molar (right), showing slight accentuation of normal tension and compression of the periodontal membrane and unaltered bone. Hematoxylin and Eosin. Orig. Mag. X80.

Fig. 7. Mesio-distal section through bifurcation area of splinted mandibular first molar. Note the compression of the periodontal membrane and resorption of tooth and bone along the distal aspect (right) and crest of the interradicular septum. Tension of the periodontal membrane fibers and formation of cementum are shown along the mesial aspect (left). The arrow indicates the direction of the occlusal force. Hematoxylin and Eosin. Orig. Mag. X40.

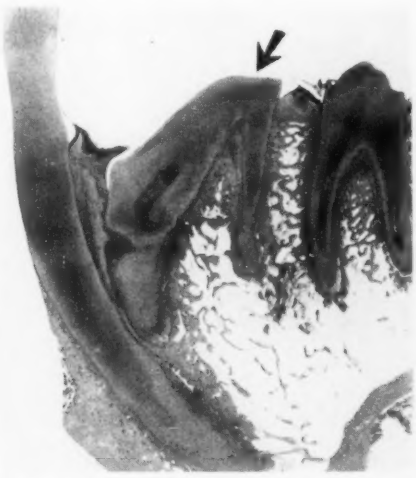

Fig. 8. Mesio-distal section through the splinted mandibular first and second premolars and the canine. The arrow indicates the direction of the occlusal force. Hematoxylin and Eosin. Orig. Mag. X4.

In the interdental space between the maxillary first and second molars the normal horizontal alignment of the transseptal fibers was altered. The fibers extended obliquely and were attached further apically on the mesial surface of the second molar. The normal contour of the interdental mesial and distal bony septa was altered. The crests were angulated instead of horizontal and tapered in an apical direction. However, the normal relationship of the epithelial attachment to the cementoenamel junction and transseptal fibers on the proximal tooth surfaces was not altered.

The first and third molars were slightly extruded from their sockets. No destructive changes were observed in the periodontium of these teeth. In relation to both teeth, the periodontal membrane was widened. The

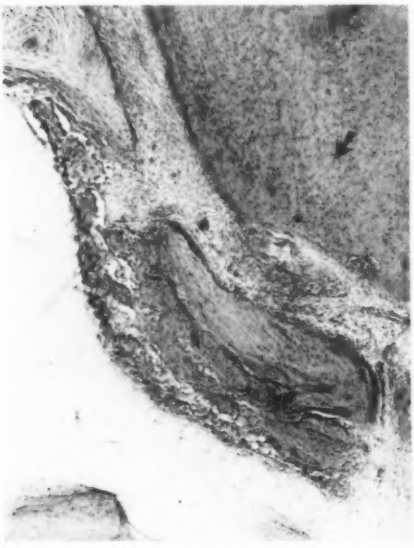

Fig. 9. High power study of the mesial aspect of the distal root of the first premolar shown in Fig. 8, showing vascularity of the periodontal membrane and resorption of the adjacent root and bone surfaces. Note the new bone formation reinforcing partially resorbed section of bone. Hematoxylin and Eosin. Orig. Mag. X110.

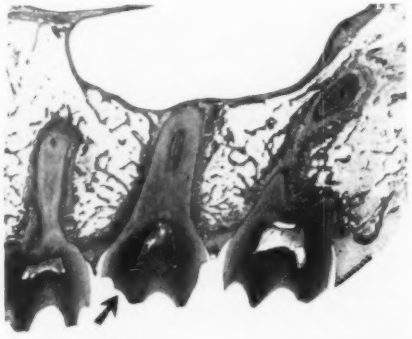

Fig. 10. Mesio-distal section of maxillary right molar area. The crowned second molar is in the center. The arrow indicates the direction of occlusal force. Hematoxylin and Eosin. Orig. Mag. X3.

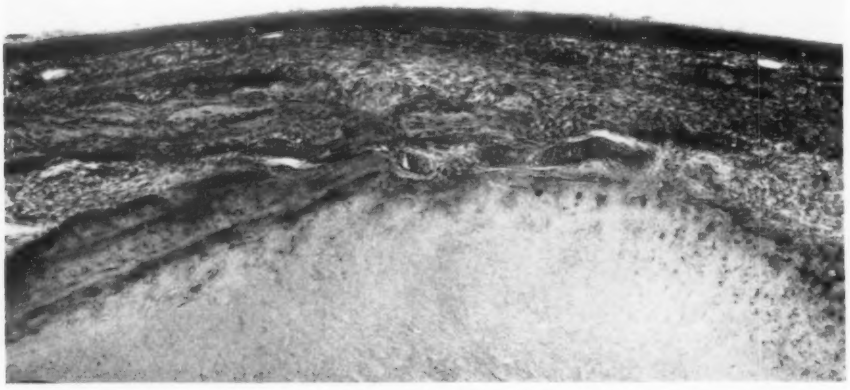

Fig. 11. Apical area of palatal root of crowned maxillary second molar showing necrosis of the periodontal membrane and resorption of root surface and alveolar bone immediately beneath the maxillary sinus. Hematoxylin and Eosin. Orig. Mag. X120.

alveolar bone was lined with a thin layer of osteoid.

Animal III, Short term non-splinted teeth, 21 days: In this animal only the maxillary right second premolar was in contact with the crowned mandibular first molar.

On the maxillary second premolar there was compression and necrosis and inflammation of the periodontal membrane at the crest of the interradicular bone in the bifurcation area (Figs. 13 and 14). The adjacent root surface was resorbed. There was osteoclastic resorption at the crest of the interradicular bone and along the bone surface in relation to the distal root. The distribution of the periodontal membrane and alveolar bone changes were consistent with an excessive force in a mesio-apical

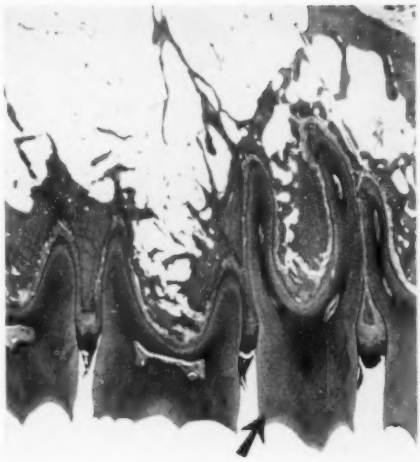

Fig. 13. Mesio-distal section through the maxillary molar and premolar areas. The second premolar (arrow) was in premature contact with the crowned mandibular molar. The direction of force is indicated by the arrow. Hematoxylin and Eosin. Orig. Mag. X5.

Fig. 12. Mesial surface of the crowned maxillary second molar showing necrosis of the periodontal membrane and resorption of alveolar bone. Hematoxylin and Eosin. Orig. Mag. X80.

Fig. 14. Mesio-distal view of bifurcation of maxillary second premolar shown in Fig. 13. Note the necrosis of the periodontal membrane and resorption of the tooth surface and alveolar bone at the distal aspect and crestal area of the interradicular septum. Some new bone formation is shown in an attempt to buttress the partially resorbed bone. The direction of occlusal force is indicated by the arrow. Hematoxylin and Eosin. Orig. Mag. X160.

Fig. 15. Mesio-distal section of the maxillary first premolar shown in Fig. 13. The tooth is slightly extruded from its socket. Note the formation of new bone trabeculae and aposition of cementum in the crestal area of the bifurcation. Hematoxylin and Eosin. Orig. Mag. X160.

direction. The first premolar and second and third molars were slightly extruded. New bone formation was observed in the bifurcation and apical areas of these teeth (Fig. 15).

Aside from slight compression of the periodontal membrane fibers on the mesial surface, the interdental areas mesial and distal to the second premolar were unaltered.

Animal II, Long term splint, 92 days: In the bifurcation areas of the splinted mandibular molars and premolars there was evidence of repair of the periodontal membrane, alveolar bone and root surface. The periodontal membrane space was widened and occupied by irregularly arranged cellular connective tissue with scattered engorged capillaries (Figs. 16 and 17). In some areas there was a semblance of fiber bundle arrangement in the connective tissue. Extensions of newly formed bone projected into the connective tissue from the bony trabeculae at the crest. There was evidence of osteoblastic activity along the bony extensions as well as along the endosteal surfaces of the underlying bony trabeculae. Occasionally, spherical masses of bone bordered by osteoid and osteoblasts were observed unattached in the periodontal membrane space. Irregularly outlined concavities in the root were filled with cellular cementum. New cementum formation was observed along the root surface.

There were no notable changes in the interdental areas between the splinted teeth. At the apices the alveolar bone was thickened.

The crowned maxillary second molar was depressed in its socket. There was evidence of reconstruction of the periodontium in the bifurcation area. The crest of the inter-

Fig. 16. Mesio-distal section through the bifurcation of splinted madibular first molar in a long term animal showing the restoration of the periodontium in the crestal area. Hematoxylin and Eosin. Orig. Mag. X25.

radicular septum consisted of young bone with numerous lacunae (Fig. 18). It was bordered by a thin layer of osteoid lined by osteoblasts. The periodontal membrane consisted of well formed collagen bundles separated by numerous engorged vessels. The collagen bundles were embedded in newly formed cementum in the repaired root surface, and newly formed bone in the interradicular septum.

The periodontal membrane and alveolar bone in the interdental areas mesial and distal to the maxillary second molar appeared essentially normal. The interseptal fibers were angulated in an apical direction.

At the apices the periodontal membrane was well formed. There was evidence of newly formed deposits of alveolar bone and cementum.

The maxillary first and third molars were extruded. Aside from new bone lining the alveolus, there were no notable changes in the periodontium.

Animal IV, Long term non-splinted teeth, 132 days: In this animal the maxillary right second premolar and the first molar were in contact with the crowned mandibular first molar. The periodontium of these teeth presented evidence of repair. In all instances, the periodontal membrane was markedly cellular, with collagen fibers grouped in irregularly arranged bundles. Numerous newly formed engorged vessels were interspersed among the fiber bundles. Small thin patches of new bone were observed along the crest and mesial and distal surfaces of the interradicular bone.

In all of the experimental and control animals there was notable inflammation of the interdental gingiva, associated with accumulations of calculus and food debris. No appreciable pocket formation was observed in the traumatized splinted or non-splinted teeth or in the controls.

DISCUSSION

The findings provide definitive information regarding the transmission of occlusal forces in fixed splints. The pattern of distribution of force among the splinted teeth was revealed by locating the periodontal tissue changes induced by excessive occlusal force. It seems reasonable to assume that physiologic occlusal forces are transmitted in a similar pattern.

The excessive occlusal force was applied to the splint in a mesio-apical direction. Only one tooth in the splint was in occlusal contact throughout the short term experimental periods. However, the periodontal tissues throughout the splint responded as if each of the teeth had been subjected to mesio-apical trauma. It is apparent from the findings that occlusal forces applied to a single tooth are transmitted to the remainder of the splinted teeth. The direction of the initial force is maintained throughout the splint. Comparable areas of the periodontium of all the splinted teeth are affected.

The bifurcation and trifurcation are the areas of the periodontium which are most susceptible to excessive occlusal forces applied in a mesio-apical or disto-apical di-

Fig. 17. High power view of the crestal area in the bifurcation shown in Fig. 16. Note the pronounced connective tissue activity with formation of new bone and cementum. Hematoxylin and Eosin. Orig. Mag. X200.

rection. In the splints, only slight changes occurred in the interdental periodontal tissues of teeth with necrotic and resorptive changes in the bifurcation area. In the non-splinted traumatized teeth on the other hand, the periodontal membrane in the interdental area was compressed and presented areas of necrosis. There was resorption of the adjacent alveolar bone. However, even in the non-splinted traumatized teeth the distribution and severity of the injury to the periodontium were greater in the bifurcation and trifurcation areas.

In contrast to the findings in the splints, the injurious effects of excessive occlusal forces upon non-splinted teeth were not transmitted to adjacent teeth. Periodontal injury was confined to the tooth subjected to the excessive occlusal force. The non-splinted traumatized teeth were less restrained from moving. As a result the teeth shifted their position when excessive occlusal force was applied. The periodontal membrane in the interdental and apical areas was compressed and cushioned the impact of the force.

It is noteworthy that excessive occlusal forces sufficient to produce necrosis of the periodontal tissues did not induce pocket formation. There was pronounced inflammation of the interdental gingivae associated with calculus deposits throughout the jaws of all the animals. There was no significant pocket formation in relation to the traumatized or control teeth.

When the non-splinted traumatized teeth were depressed in their sockets the marginal periodontal tissues moved in synchrony as a unit with the tooth. The transeptal fibers changed their direction but did not shift their position on the tooth surface.

Fig. 18. Mesio-distal section through the bifurcation of the crowned maxillary second molar in long term animal showing the restoration of the interradicular bone. The relatively immature laeunar bone is bordered by a zone of osteoid with osteoblasts. Note the well-formed collagen fibers of the periodontal membrane and numerous dilated blood vessels. Hematoxylin and Eosin. Orig. Mag. X100.

The position of the epithelial attachment and the gingival fibers on the tooth surface was unchanged as was their relationship to each other.

Repair and restoration of the periodontal tissues were observed in the long term experimental animals. Even in the short term animals reparative changes accompanied the periodontal destruction. This confirms the generally held impression that periodontal tissue changes induced by excessive occlusal force are reversible, if the force is alleviated. The severity of the occlusal force was reduced when the individual teeth in premature contact were depressed in their sockets.

When the bite was opened on a single tooth, occlusal contact of the entire dentition was ultimately reestablished by intrusion of the involved tooth and extrusion of the teeth which were initially out of contact. It is of interest to note that the splinted teeth were not depressed in their sockets. Crowned and non-crowned traumatized teeth presented comparable destructive changes in the periodontium. The possibility of an injurious effect of tooth preparation was ruled out by this finding.

The present study does not lend itself to definitive opinions regarding the benefits or shortcomings of fixed splints. It was demonstrated that when only one tooth in a splint is traumatized the periodontium of the remaining teeth also suffers. This discourages the impression that including a tooth in a fixed splint shields it from the risk of injury from occlusal forces. Even splinted teeth which were not in occlusal contact did not escape injury when only one member of the splint was traumatized.

On the other hand, the findings could be interpreted as indicating that fixed splints provide for a distribution of occlusal forces which is beneficial. When one of the teeth in a splint is subjected to excessive occlusal force the remaining teeth share the load. It could be theorized that the impact of the force upon the periodontium of the affected tooth would thereby be lessened. In some instances this might suffice to reduce the severity of the force so that it would not exceed the adaptive capacity of the periodontium and injury to the tissues would be prevented.

CONCLUSIONS

The distribution of occlusal forces among teeth in fixed splints was demonstrated in experimental animals by studying histologic changes in the periodontal tissues.

When an excessive occlusal force was applied to one tooth in a splint the periodontal tissues of all of the splinted teeth suffered comparable injury.

The injurious effect of excessive occlusal forces upon non-splinted teeth was not transmitted to the adjacent teeth.

The bifurcation and trifurcation are the areas of the periodontium which are most susceptible to excessive occlusal forces applied in a mesio-apical or disto-apical direction.

The authors acknowledge with thanks the technical assistance of Miss Miriam M. Krasnoff, research technician in our laboratory.

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UPPER NEW YORK STATE SOCIETY OF PERIODONTISTS

A new organization has come into existence in the past year, with the title of "The Upper New York State Society of Periodontists." Just recently it has been incorporated. This society is open to men whose practices are limited to Periodontics, and who meet certain other requirements in the constitution. This latter is similar to The Mid West Society's constitution except for a few details.

The pro tem officers are Dr. Frank Fiaschetti, President and Dr. Robert S. Wolfsohn, Secretary-Treasurer.

For further information about this organization please write Dr. Robert S. Wolfsohn, 175 Linwood Avenue, Buffalo 9, New York.

Should the Teeth be Scaled Prior to Surgery?*

by ROBERT GOTTSEGEN, A.B., D.D.S.,** *New York, N. Y.*

A SURVEY of the literature reveals that the reasons offered for preparatory subgingival scaling have been 1) reduction of inflammation with less hemorrhage at time of operation, 2) reduced likelihood of excess granulation tissue in healing, 3) less chance of infection, 4) quicker healing, 5) elimination of the need for surgery. To these most frequently repeated reasons have been added 6) if the gingiva is made fibrous and firm by reduction of inflammatory edema first, it can be carved to a predictable desired form at gingivoplasty—by Goldman,[1] and 7) the period of scaling is a trial period during which time the patient demonstrates his willingness and ability to carry on proper oral hygiene, since periodontal surgery is reserved only for those who can, and will, cooperate to the utmost—by Ramfjord.[1]

In spite of traditional repetition and acceptance, most of these reasons turn out to be opinions unsupported by evidence. In searching the literature, one finds that comments on this dispute are in sections like "In Our Opinion," which was once a feature of the *Journal of Periodontology*, or in panel-type presentations like "Is Scaling Prior to Gingival Surgery a Necessary Procedure?" in the *Journal of the Western Society of Periodontology* in 1956.[1] Nowhere is there any clear-cut experimental evidence to support or refute any of the claims in this argument, except for the paper of Ambrose and Detamore[2] in which an attempt is made to determine histologically the condition of the gingiva and its healing rate when surgery is done with and without preliminary scaling. Unfortunately, this paper is inconclusive, as its own authors admit. Misleadingly, one is referred to the bibliographical references by the statement that, "investigations carried out previously have been largely on a clinical basis." However, a survey of those references reveals no investigations at all, clinical or otherwise, just statements of opinion.

Let us now consider the alleged benefits of preliminary scaling one by one.

Reason number 1: Glickman has stated, "No purpose is served by 'half-scaling' a tooth and waiting for the gingiva to 'half-heal,' while permitting some of the very irritant responsible for the gingival inflammation to remain on the root surface. Insufficient thoroughness in scaling and root planing should not be camouflaged under the guise of 'pretreatment' ostensibly to benefit the pocket wall which is going to be removed anyway. More pockets would be eliminated more efficiently if the effort expended on inadequate preliminary scaling would be devoted to assuring the thoroughness of scaling and root planing which is the prerequisite for the success of the unembellished gingivectomy."[1]

Glickman's points seems to be that 1) incomplete scaling does no good; 2) resorting to gingivectomy after incomplete scaling is an admission of defeat as to one's skill with a curet.

However, if one accepts the proposition that periodontal surgery is better executed when bleeding is less, then even incomplete preliminary scaling helps.[3] How often have we had the experience of vigorously scaling an area, seeing the inflammation materially subside and then, at surgery, finding one or several plaques or flakes of calculus still firmly attached to the now exposed and visible root surfaces. Even though the prior scaling was incomplete and the in-

*Presented in modified form as part of a panel of this title at the annual meeting of the American Academy of Periodontology, Santa Monica, California, October 14, 1960.

**Section of Periodontology, School of Dental and Oral Surgery, Columbia University, New York, New York.

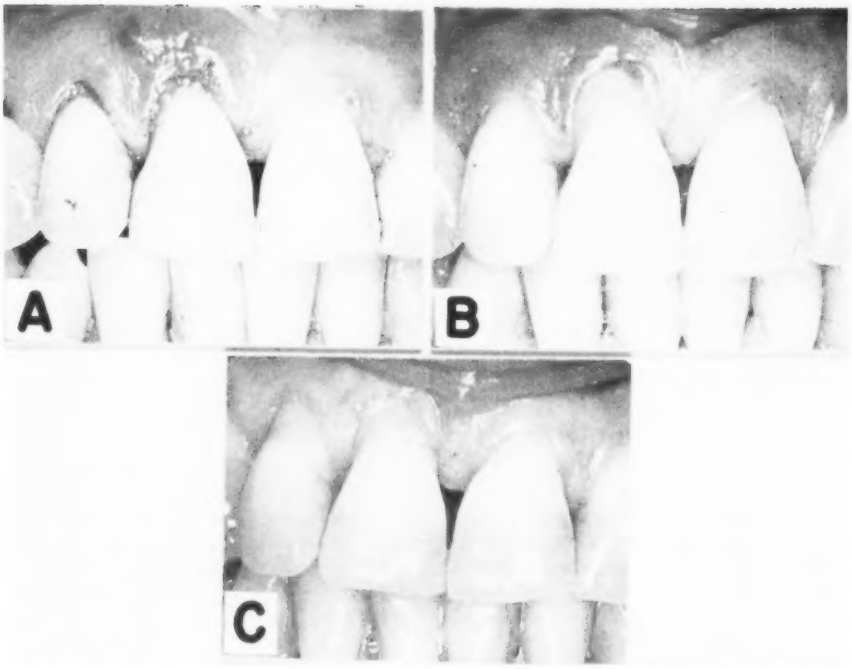


Fig. 1. R.F., woman, age 48. Upper right central incisor with 7 mm. labial pocket. a. At presentation, showing inflammation of marginal and attached gingiva and increased vascularity extending above muco-gingival line into alveolar mucosa. b. One week after thorough root scaling. Reduction of gingival inflammation and mucosal vascularity. c. Two months later, elimination of gingival inflammation and clinical reduction of pocket depth to 2-3 mms.

flammatory involvement of the gingiva did not completely disappear, there was enough of a change to reduce the amount of hemorrhage and, consequently, to make it easier to visualize the residual calculus. When bleeding is profuse it is often difficult to carry out the thorough root scaling and planing which Glickman holds is a "prerequisite for success."

The gingival blood supply is largely made up of vessels which course through the mucosa on their way to the gingiva. Since inflamed tissue requires an increased blood supply, inflammation in the gingival zone may result in vascular dilatation in the adjacent mucosa. Therefore, in the presence of gingival inflammation, increased hemorrhage may result whether the incision is in the gingiva, at the muco-gingival line or in the mucosa.

The quality and severity of the inflammatory involvement influences the state of vascularity of the mucosa (Fig. 1). So, to the degree to which gingival inflammation is reduced, muco-gingival surgery is made less bloody and thus less difficult. Final hemostasis can be achieved more easily and, accordingly, better pack adaptation and retention is assured.

Reason number 2: Less granulation tissue forms in healing. Orban was seemingly bothered by this problem because for years he taught and advocated the application of silver nitrate or trichloracetic acid to the healing granulation tissue bed every two or three days post-operatively at the time of pack change to subdue exuberant excess granulation. This was recommended in papers written in 1941, 1945 and 1947.[4,5,6] However, it is interesting that in the 1958 textbook by Orban, Wentz and others,[3]

Fig. 2. R.S., woman, age 29. Over-granulation two weeks following surgery (gingivectomy, osteoplasty and muco-gingival procedure). All teeth in this segment were somewhat mobile and since the surgical cement was anchored to the teeth, there was movement of it over the healing tissue bed whenever the teeth were brought together.

although the routine use of silver nitrate or trichloracetic acid is still advocated, the reasons for their application have been changed. It is now recommended for improving healing, reducing inflammation, removing necrotic surface tissue elements, decreasing bacterial population, but no word about controlling over-granulation. Is this because over-granulation was no longer a problem to Orban?

And, if so, it is interesting to speculate why. Was it because his presurgical preparation, his scaling, was better? Support for this hypothesis can be gained from Orban's own writings. In 1941 he said, ". . . reduce acute gingival inflammation and thus reduce bleeding . . . by scaling a day or two previous to the gingivectomy. *This need not be the most thorough** but all rough parts of deposits should be removed."[4] Again, the 1945 description of Orban's gingivectomy technic states that he measures the depths of pockets with an explorer and "by means of the sharp point of the explorer all irregularities (calculus deposits) will be evident to the operator who will then have information as to the condition of the root surface."[6] In other words, there was still abundant calculus present at the time of operation. Preliminary scaling was still only a cursory procedure. But in his later teaching and in the 1958 textbook[3] there was much more emphasis on adequate root scaling and nowhere in the book is permission granted to be so casual about pre-surgical calculus removal.

Or was over-granulation no longer a problem because the surgery had become more extensive? By 1958, the principles of osteoplasty and muco-gingival surgery had become well established and no longer was his periodontal surgery confined to the attached gingiva as Orban's earlier writing and photographs illustrate. Could it be that wider excision of tissue, frequently removal of the entire zone of the attached gingiva, reduced postoperative excess granulation tissue as a problem, even in the face of residual calculus deposits?

In our experience, the problem of excess granulation has only been an infrequent one and one cannot but wonder if this might be due in part to the standards of scaling which were set up for us by such men as Isadore Hirschfeld and, in part, to the fact that we were carrying out more extensive surgical procedures fairly early under the stimulus of men like Schluger.

When over-granulation does occur (Fig. 2), there seem to be two major causes. One is movement of the surgical pack over the healing surface and the other is incomplete calculus removal at the time of surgery. The dressing may be movable if the teeth to which it is anchored are loose; hence, loose teeth should be splinted preoperatively. Or, it may be loose if incomplete hemostasis has allowed oozing blood to lift up the cement before it has set. Further, it is conceivable that if the cut edge of gingiva rests very close to an unscaled flake of calculus, this may act as enough of an irritant to cause granulation tissue overgrowth. Since both the ease of hemostasis and the ease of calculus removal are influenced strongly by the amount of operative hemorrhage, we have another strong reason for reduction of inflammation by adequate prior scaling.

*Italics are not in original.

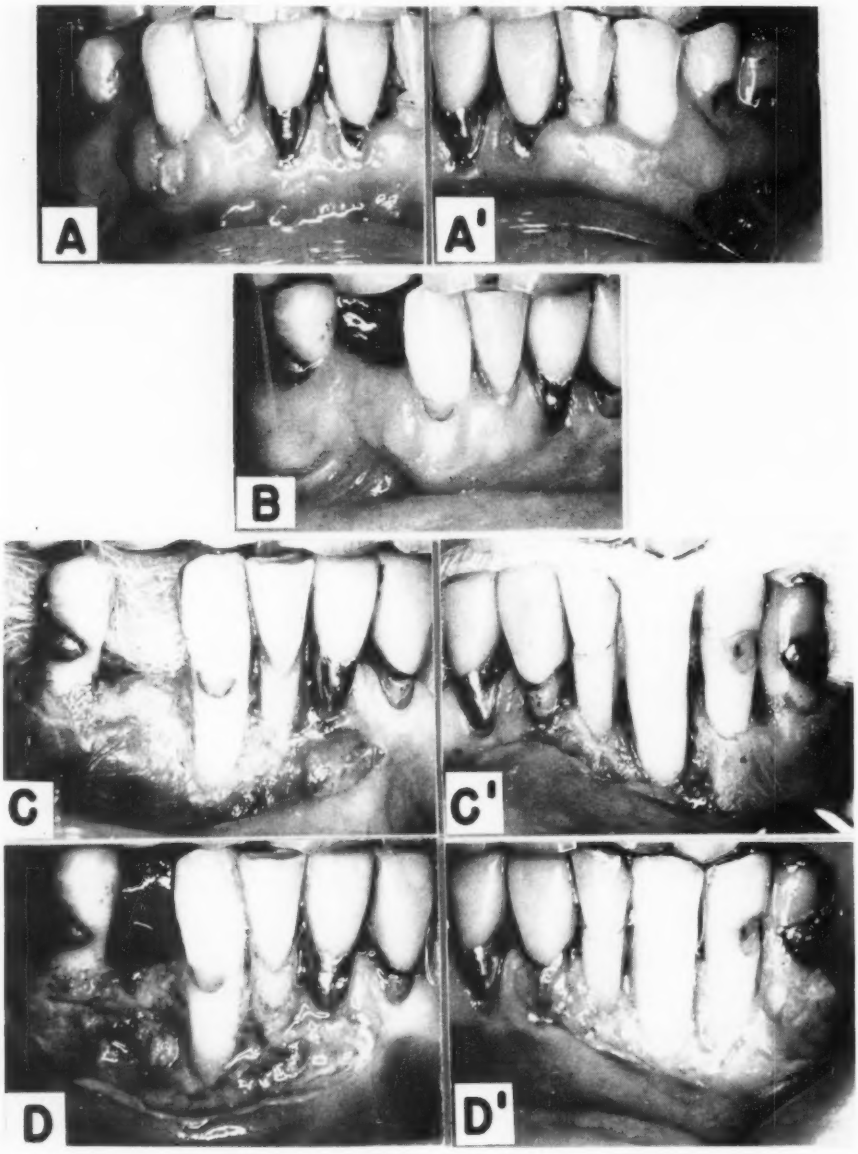
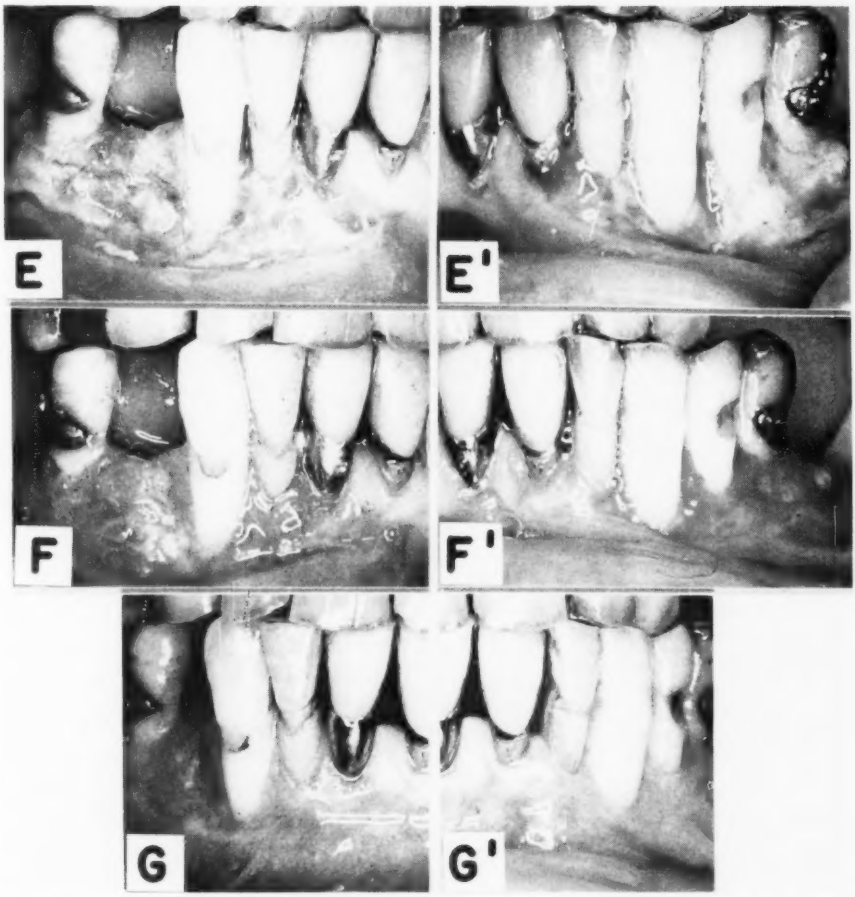


Fig. 3. S.M., woman, age 45. Comparison of healing between right side, pre-surgically scaled, and left side, not scaled. a. As presented. b. Ten days following thorough subgingival scaling, right side only. c. At operation. The surgical procedures were as comparable as it was possible to make them. These pictures show the areas after root scaling and bone recontouring have been completed. d. Three days postoperative.



e. Seven days postoperative. f. Two weeks postoperative. g. One month postoperative. There seems to be no difference in healing rate or amount of granulation tissue between the side thoroughly scaled before surgery, the right, and that not scaled, the left. In this case, the surgery involved complete removal of the attached gingiva.

There is, to the best of my knowledge, no experimental evidence showing whether more granulation tissue results from surgery on unscaled areas than on scaled. In the few cases I have studied, I have been unable to detect any difference in healing rate or amount of granulation on a segment previously scaled versus a segment not pre-surgically scaled, where each patient acted as his own control and where, of course, hemostasis was effective and complete and the pack was rigid and immovable (Fig. 3).

Recent evidence has suggested that not all post-operative excessive "granulation tissue" overgrowth is simply that. In examining some of these cases histologically, I have found one case of reparative giant cell granuloma (Fig. 4) and suggest that if more routine biopsies of this complication were investigated such a finding would not be unique or rare. Particularly might this be true following osseous surgery. (This case will be reported separately.)

Reason number 3: There is less chance of

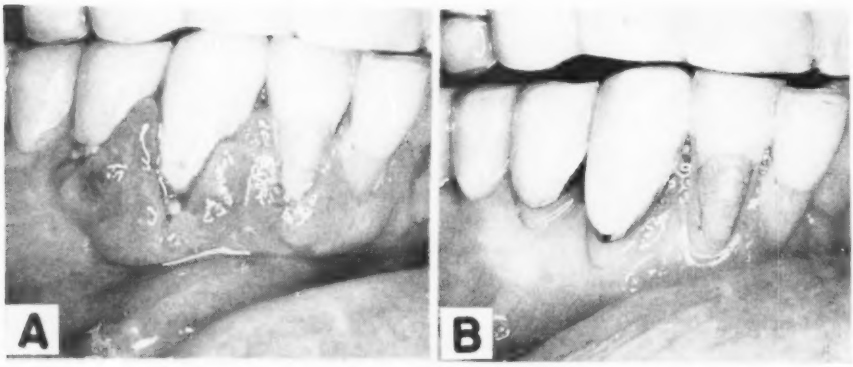


Fig. 4. P.A., man, age 51. a. Over-granulation three weeks following surgery (gingivectomy, osteoplasty, muco-gingival procedure). Histological examination proved this to be a reparative giant cell granuloma. b. One month following simple excision of the mass shown in (a).

infection. It has been stated that prior scaling reduces the number of bacteria and foreign bodies in the field. This may be significant. A study should be made as to whether there is any difference in the transient bacteremia caused by periodontal surgery in prepared versus unprepared areas, or whether the presence or absence of a suppurative exudate makes any difference. Of course, it could be argued that even though there may be less bacteremia when surgery is done on non-inflamed tissue around clean smooth roots, several episodes of transient bacteremia were caused by the scaling sessions necessary to make them that way.

Reason number 4: A traditionally held reason for pre-gingivectomy scaling is that healing is more rapid when it is done. I am not aware of any investigations supporting this for all types of periodontal surgery. Goldman has written: "It has been noted that incision into a clinically soft, edematous, friable tissue results in poor healing. Granulation tabs result and complete epitheliazation of the wound is sometimes long delayed."[1] This seems to apply more to purely gingival surgery than to mucogingival or to mucosal. There is no experimental evidence on this problem, but experience suggests that mucosal surgery heals just as rapidly and just as well even when the adjoining gingiva is inflamed, as long as it is removed during the operation (Fig. 3).

Reason number 5: There is an occasional disappearance of the need for surgery (Fig. 1). There is no doubt that many cases respond to meticulous sub-gingival scaling and root planing alone, and we can predict these cases with greater accuracy now as our knowledge of and experience with both the possibilities and limitations of this technic grow.

Reason number 6: The gingiva can be carved to a predictable form when it has been rendered firm and fibrous rather than edematous and friable. We can agree with this further argument of Goldman's[1] if the surgery is to be within the attached gingival zone strictly, as in the gingivoplasty.

Reason number 7: Ramfjord's contention that the period of scaling is a trial period during which the patient documents his interest and ability in oral hygiene. Most patients in a private periodontal practice have demonstrated their willingness to cooperate by seeking out and subscribing to treatment in the first place. They will generally do their part if for no other reason than to protect their investment in the time, discomfort and expense of treatment. However, there are some patients

who feel that their own responsibility has ended once they have entered into treatment. "The periodontist is being paid; let him do the work" is what they are saying. It is wise to recognize and correct this type of patient early in the course of treatment.

In many cases, however, oral hygiene can be carried out successfully only after surgery has been completed. Poor gingival contour, excess tissue or a frenum may have prevented proper cleaning.

What conclusions can be reached? In agreement with Ramfjord it may be stated in general that while "scaling prior to periodontal surgery is not 'necessary' . . . (it) is rational, beneficial, safe, sensible and practical."[1]

To this statement should be added:

1. Pre-surgical scaling, even when incomplete, results in less hemorrhage at the time of operation with its attendant advantages.

2. Pre-surgical scaling reduces the time required at operation and, therefore, the trauma of operation.

3. For purely gingival surgery, such as the gingivoplasty, preliminary complete scaling and root planing is almost essential to render the tissue firm and fibrous so it can be carved to a predictable form and also to achieve maximum shrinkage which may eliminate the need for surgery altogether.

4. For mucosal or muco-gingival surgery in which the attached gingiva is completely removed, prior scaling is less necessary, and in the absence of a potential bleeding problem may often be left incomplete.

Any investigation which purports to show the influence (or lack of influence) of pre-surgical subgingival scaling by comparing the behavior of a "scaled" segment to that of an unscaled segment has a built-in unknown which makes the evaluation of the experiment uncertain, that being the quality of the scaling.

ACKNOWLEDGMENTS

My thanks to Dr. Charles Berman for his constructive suggestion and to Mr. Nat Kanter for his photographic assistance.

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INDIANA UNIVERSITY

Indiana University School of Dentistry will present a participation course in Periodontics on six consecutive Wednesdays beginning February 28, 1962 (February 28, March 7, 14, 21, 28; April 4). Dr. John Pritchard from Fort Worth, Texas, and the staff of the Periodontology Department, will give demonstrations and lead the discussions in various aspects of periodontal therapy.

Enrollment will be limited; the fee is $150.00.

For further information please write the Dean, 1121 West Michigan Street, Indianapolis 2, Indiana.

Diet Consistency and Periodontal Disease in Old Albino Rats

by PHILIP PERSON,* *Brooklyn, N. Y.*

IN the course of a study of the effects of protein depletion upon oral structures of old rats, we observed an osteoporosis in the mandibles of pair fed and ad libitum fed control animals, as well as in the mandibles of depleted animals.[1] The diets used in these experiments were semisynthetic, and being suspended in an agar base, were quite soft. Thus, animals could bolt their food without chewing, so that a form of disuse atrophy of the periodontium had to be considered as a possible basis for the observed osteoporoses. To test this hypothesis, an experiment was designed in which Purina rat checkers in different physical consistencies, was fed to groups of rats. The checkers were used as the hard biscuit obtained from the supplier, as a fine powder, and as a fine powder suspended in agar. Purina rat checkers were selected for beginning experiments rather than the diets used in the previous study[1] because variation in consistency of the diets used in the protein depletion experiments could not be accomplished without seriously altering composition and nutritive value. The rat checkers on the other hand, could be altered in physical consistency without seriously affecting composition or nutritive value.

Results were quite surprising in that periodontal disease developed in the animals on the hard consistency diet.

METHODS

Three groups of old, male, adult, white rats containing 6 animals per group, were established. The average body weights were: Group I, 517 ± 20 grams; group II, 521 ± 14 grams; group III, 523 ± 31 grams. Group I received intact Purina rat checkers; group II received a 500 micron (particle size) powder prepared from the rat checkers;** group III received the same powder suspended in liquefied agar-agar, and resolidified. All diets and water were provided ad libitum. Animals were housed 6 in a cage, and were kept on experiment for 12 weeks, after which the animals were sacrificed by ether inhalation. The salivary glands were dissected out and placed in 10% formalin. The mandibles were hemisected, freed of overlying skin and muscle and also fixed in 10% formalin. Hematoxylin and eosin stained sections were prepared from the fixed tissues.

RESULTS

A. *Lack of Involvement of Salivary Glands.* Masticatory effort naturally varied with the consistency of the diet employed. Animals in group I (checker diet) had to expend most effort in mastication of the checkers. Animals in group II (powder diet) expended less effort, and in addition must have required greater amounts of saliva during mastication, since their diet consistency was that of a fine dusty powder. Group III animals (agar diet) masticated least; they bit off a chunk of the agar suspended diet and would often swallow it without a chew.

In view of the above, we wished to know whether histologic differences in salivary gland structure might result. However, study of hematoxylin and eosin stained sections of the salivary glands of all animals revealed no significant differences between any of the groups.

B. *The Periodontium—Gross Changes.* The changes to be described for each group were present in many, but not in all animals of the group. The most marked changes were seen in animals of group I (checker diet). In these animals the molar

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**We wish to thank Mr. W. J. Mann, Dynatrol Inc., New York, N. Y., for preparation of the powdered diet, the particles of which were sifted through a sieve with 500 micron openings.

Fig. 1 (left). Marked tooth wear and resulting Periodontal pathology in animal on rat checker diet. Note that the second and third molar occlusal surfaces are worn to the level of the gingiva. Gingival detachment and pocket formation are evident. Formalin fixed specimen.

Fig. 2 (right). Degree of tooth wear seen in animals on powdered diet and agar-suspended powder diet. Note intact interdental papillae and accumulations (of agar?) at the gingival margins. Formalin fixed specimen from group III (agar diet) animal.

teeth were often worn down to the level of the gingiva. As a result, food impaction areas developed mesiodistally and buccolingually, with gingival detachment, calculus formation, and typical pathologic sequelae, as may be seen in figure 1. The very *extreme* degree of tooth wear described above was seen in four of the group I animals and not seen in any of the group II (powder diet) or group III (agar diet) animals. The animals in the latter 2 groups exhibited a lesser but similar degree of tooth wear. An interesting feature was that the animals in group II (agar diet) had accumulations of soft debris at the gingival margin (see figure 2) which were not present in any of the other groups. The accumulated material was *not* like materia alba in that it was clearer and more transparent; it appeared to be agar-agar, per se. It was not associated with pathology.

Microscopic Changes. The histologic appearance of the periodontium of animals on the powder and agar diets showed no pathologic changes. In figure 3 is shown a survey view of a section from the mandible of a group III (agar diet) animal which may also be considered representative for group II animals. Bone density in these animals was not lessened in any way, nor were significant degenerative changes present. The level of alveolar bone is just below the cemento-enamel junction. The epithelial attachment is located at the cemento-enamel junction. The appearance of the interdental gingival papillae, and other periodontal structures is typical.

In contrast with the above, we see in figure 4, a survey view of a mandible from a group I animal on the checker diet. Note that considerable pathology has occurred as a result of tooth wear and food impaction. There are accumulations of debris and calculus associated with loss of alveolar

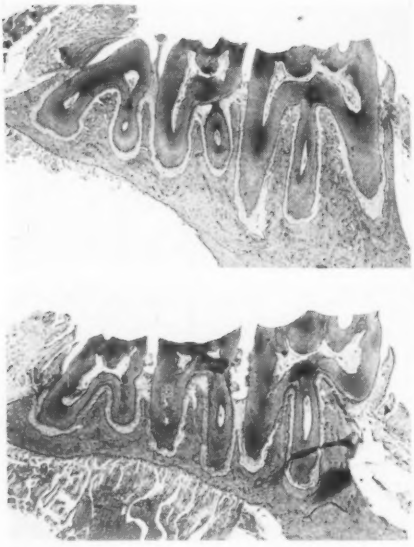

Fig. 3 (above). Low-power survey photomicrograph demonstrating typical appearance of the periodontium of group II (powder diet) and group III (agar diet) animals, and absence of pathology.

Fig. 4 (below). Low-power survey photomicrograph illustrating pathology seen in group I (checker diet) animals experiencing extreme tooth wear. Note loss of interdental gingival papillae and interproximal accumulations of debris and calculus. The levels of interprodimal alveolar bone crests are markedly reduced, the heights of the inter-radicular bony crests are not changed.

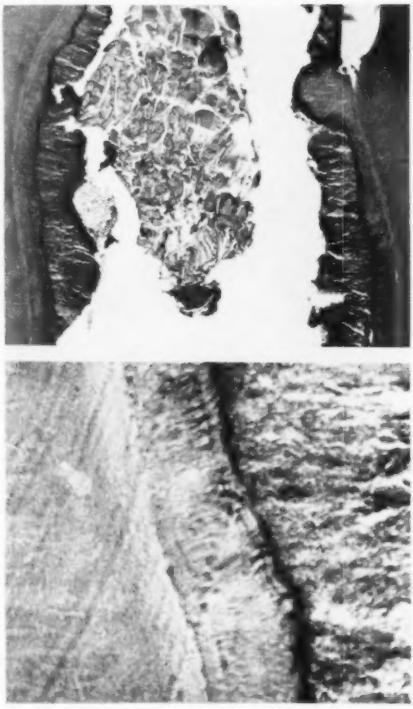

Fig. 5 (above). Photomicrograph illustrating interproximal accumulation of debris and calculus.

Fig. 6 (below). Higher power view of junction between cementum and calculus.

bone in the interdental areas and loss of the interdental gingival papillae. In figures 5 and 6, higher magnification of the calculus formation may be seen. Such accumulations of calculus in the rat are indeed rare. The intimate binding of the calculus to cementum is seen in figure 6.

DISCUSSION

It is of interest and significance that tooth wear and food impactions, with resultant periodontal pathology can be produced in the albino rat solely by alteration in diet consistency. In the past, production of the above type of gingival pathology has been accomplished primarily with the aid of direct operative interferences, i.e., insertion of amalgam at the gingival margin, various gingival and tooth cutting procedures, etc.

In 1958, Stahl, Miller and Goldsmith[2] reported in hamsters, the occurrence of periodontal pathology associated with differences in diet consistency. In their experiments Purina pellets, per se, and pellets ground to a granular consistency were fed to different groups of animals. In the animals receiving the intact pellet diet, no significant pathology was noted. However, the animals receiving the granular (ground) pellets developed food impactions with resultant pathology similar to that described in this paper. The dimensions of the granules were not given, but it is evident that their size was much larger than the particle size of the powder used in our diets II and III. The above authors did not mention that tooth wear was in any way associated with the development of the pathology noted in

the granule consuming animals, which were young adults. Of further interest in this regard, is the recent report by Stewart and Burnett[3] concerning the effects of diet composition on calculus formation in young albino rats. These authors note on page 12 of their article, "The checkers diet was sufficiently abrasive that molar cusps were usually worn down after some time on the diet." However, Stewart and Burnett did not find the degree of tooth wear which occurred, to be associated with calculus formation or periodontal pathology. This is understandable and is not in conflict with our findings since their animals were very young (i.e., 25 days old at the start of the experiment) and the degree of tooth wear (as shown in their figure 3) was far less than that encountered in our older animals.

It is quite significant that in two different but commonly used rodent species, a serious type of periodontal pathology may be produced solely by alteration in diet consistency (as shown in the present experiment and that of Stahl, Miller and Goldsmith[2]). It is also of particular interest that the phenomenon of tooth wear, so important in the biology of oral tissues, is readily influenced by the relatively simple variable, diet consistency. That this should be, is of course not surprising. However this obvious relationship has not been utilized for experimental purposes in the past. The prediction may be ventured that it should be possible to breed strains of animals with marked susceptibility and also marked resistance to tooth wear. But even before this is accomplished, it is now apparent that studies of endogenous and exogenous factors involved in tooth wear are possible and should be undertaken.

SUMMARY

A study has been made of the effects of diet consistency upon the teeth and periodontium of very old albino rats. The animals were fed intact Purina rat checkers as obtained from the supplier; as a fine 500-mesh powder prepared from the checkers; and as the same powder suspended in agar-agar. In some of the animals receiving the intact checkers, an extreme degree of tooth wear was seen, in which the crowns of the molar teeth were worn down to the gingival margin. In these same animals food impaction, calculus formation and severe gingival recession were produced. Such changes were not seen in animals which received the powder and the powder-agar diets.

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THE NORTHEASTERN SOCIETY OF PERIODONTISTS, INC.

The next meeting of the Northeastern Society of Periodontists will be held on November 3 at the Park Sheraton Hotel, Seventh Avenue and 55th Street, New York, N. Y.

The speakers at this meeting will be Sigurd Ramfjord, Ph.D., Ann Arbor, Michigan; Morton Amsterdam, D.D.S., Philadelphia, Pa.; Laszlo Schwartz, D.D.S., New York City; Isador Hirchfeld, D.D.S., New York City; Edward Zegarelli, D.D.S., New York City; Norman Orentreich, M.D., New York City.

A Comparison of Ultrasonic and Hand Scaling

by GREGORY W. STENDE, B.S., D.D.S.,* AND ERWIN M. SCHAFFER, D.D.S., M.S.D.,**
Minneapolis, Minnesota

SINCE 1955, when Zinner[1] reported the application of ultrasonics to periodontics, there have been a number of clinical reports based on this subject.[2,3,4,5,6,7] These papers include clinical observations and impressions of its effectiveness in removing calculus. They indicate that this instrument is effective for calculus and stain removal, and it removes the deposits easier, quicker, and with less hemorrhage.[2,3,4,5,6,7]

A recent study[8] compared files, hoes, and curettes in root planing. Curettes were the most effective in removing calculus and in obtaining a smooth surface.

The question naturally arises, "Are ultrasonic scalers more efficient than curettes in removing calculus?" The following clinical study was completed attempting to answer this question.

PROCEDURES

A total of 150 teeth, that were condemned for prosthetic reasons, were used in this project. Prior to extraction, the teeth were scaled with one set of four types of instruments, two sets of hand curettes and two sets of ultrasonic instruments. The names and numbers of the four types are as follows:

McCall curettes #13, 14, 17, 18

Gracey curettes #1, 2, 9, 10, 13, 14

Ultrasonic (regular) #P-2L, P-2R, P-4L, P-4R, P-3

Ultrasonic (similar to McCall) #P-10, P-11L, P-11R

On any given tooth, only one set of the four types was used. The teeth were scaled randomly. Records were kept of the annotation of the tooth and the instrument used. The depth of the periodontal pockets in these teeth varied from 3 to 8 mm.

TABLE I
Number of Teeth Scaled

Instrument	*Anterior*	*Posterior*	*Total*
Cavitron-Regular tips	19	15	34
Cavitron-McCall tips	26	15	41
Gracey curettes	21	18	39
McCall curettes	24	12	36

After all of the teeth for this project were collected, the results were tabulated blindly. The root surfaces were divided into eight areas, namely:

mesial	distal
mesiobuccal	distolingual
buccal	lingual
distobuccal	mesiolingual

Whenever calculus remained on one of the preceding areas, it was recorded. After all of the surfaces were evaluated on all of the teeth, the instrument used on the given teeth was recorded. The results below are tabulated on anterior and posterior teeth.

TABLE II
Efficiency on All 8 Surfaces

	Anterior	*Posterior*
Cavitron-Regular tips	88.16%	90.83%
Cavitron-McCall tips	97.60%	69.17%
Gracey curettes	90.48%	83.33%
McCall curettes	94.18%	87.50%

To calculate the efficiency of calculus removal, the number of surfaces per teeth

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Supported by a grant from the Minnesota Dental Foundation.

(8) was multiplied by the number of teeth to get the total number of surfaces. The number of pieces of calculus left was divided by the total number of surfaces and in turn was multiplied by 100. The result was the percentage of surfaces with calculus left on them. Subtracting from 100 gives the efficiency result.

$$\frac{a}{(x)\ (8)}\ 100 = Y$$

$100 - Y =$ Efficiency
$a =$ pieces of calculus left
$x =$ number of teeth
$8 =$ surfaces of tooth
$Y =$ per cent of surfaces with calculus

For individual surfaces (such as mesial) the efficiency is calculated according to the formula:

$$\frac{a}{(x)}\ 100 = Y$$

$100 - Y =$ Efficiency

The Cavitron-McCalls were the most efficient for anterior teeth and the Cavitron-Regulars were the least efficient. On the posterior teeth the Cavitron-Regulars were the most efficient and the Cavitron-McCalls were the least. In efficiency, McCalls and Graceys curettes ranged between the ultrasonic instruments. (Table II)

In evaluating the efficiency on each individual surface for anterior teeth using all four types of instruments, it was observed that the order of decreasing efficiency from most to least is as follows: mesiobuccal, buccal, distobuccal, mesiolingual, lingual, distolingual, mesial and distal. (Table III)

For posterior teeth, the order of efficiency for all four types of instruments was as follows: buccal, mesiobuccal, lingual, distolingual, mesial and distal. (Table IV)

DISCUSSION

The exact amount of calculus prior to scaling could not be determined. To compensate for this, four or more teeth were scaled in each mouth using one type of instrument on one tooth, another on the next tooth and so on. Thus, a trend can be detected regarding efficiency.

It appears from the relative figures that there is a very little difference between the four basic types of instruments in scaling. However, it must be understood that the ultrasonic instrument will not plane the root surface. For successful periodontal therapy in either eliminating gingival inflammation or periodontal pockets the root of the tooth must be planed until it is smooth and hard. The ultrasonic scaler will not plane the surface smooth but it can be done with hand instruments. If the ultra-

TABLE III
Efficiency by Individual Surfaces
Anterior Teeth

	Cavitron Regulars	*Cavitron McCall's*	*Gracey's*	*McCall's*
M	84.21%	100%	71.43%	91.67%
MB	100%	100%	100%	100%
B	100%	100%	100%	100%
DB	94.74%	100%	100%	100%
D	73.68%	88.46%	61.91%	75%
DLi	78.95%	96.15%	100%	91.67%
LI	84.21%	100%	95.24%	100%
MLi	94.74%	96.15%	95.24%	95.83%

TABLE IV
Efficiency by Individual Surfaces
Posterior Teeth

	Cavitron Regular	*Cavitron McCall's*	*Gracey's*	*McCall's*
M	66.67%	46.67%	66.67%	75%
MB	92.33%	100%	100%	83.33%
B	100%	80%	100%	100%
DB	92.33%	100%	83.33%	91.67%
D	80%	0%	55.56%	75%
DLi	92.33%	60%	83.33%	91.67%
Li	100%	80%	77.78%	91.67%
MLi	100%	86.67%	100%	91.67%

sonic instruments are used for preliminary root debridement, they must be followed by routine root planing with hand instruments. The ultrasonic instrument is an adjunct but not a substitute for hand instrumentation.

SUMMARY

Scaling was employed to remove calculus on 150 teeth prior to extraction. An equal number were scaled with ultrasonic instruments and an equal number with hand curettes. From a blind method of evaluation, it appeared that there was very little difference in efficiency in calculus removal with either method.

On the posterior teeth, the surface most often free of calculus was the buccal, while in the anteriors, the surface most often free was the mesiobuccal. The surfaces on which the most calculus remained were the mesial and distal, on both the posterior and anterior teeth.

It must be understood that the ultrasonic instrument will not plane the root surfaces; this can be accomplished only by hand instruments. It is necessary to plane the roots; consequently, the ultrasonic instrument is only a supplement to scaling and not a substitute for hand instrumentation and root planing.

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TEACHERS IN PERIODONTOLOGY NEEDED

The Editor of the JOURNAL OF PERIODONTOLOGY has received several requests in the past few months for the names of individuals who might wish to be considered for responsible full time teaching positions in periodontology. Anyone who is interested is invited to send to the Editor a curriculum vitae which will be reproduced and sent to anyone who requests the names of possible teachers.

The Editor of course can assume no responsibility for finding positions for people who apply. Please send the information to M. K. Hine, Editor, 1121 West Michigan Street, Indianapolis 2, Indiana.

The Ultrasonic Wound — Some Microscopic Observations

by Sol J. Ewen,* d.d.s., *New York, N.Y.*

In 1957 while ultrasonic vibrations were being used for the removal of supra-gingival calculus a clinical burn or coagulation was inadvertently induced on the lateral surface of the tongue of a patient (figure 1A).[1] The epithelium turned white and resembled most closely the white pellicle produced by the application of escharotics, such as trichloracetic acid, phenol or silver nitrate to oral mucosa. The wound healed uneventfully at the end of one week (figure 1B). Shortly thereafter, a number of ultrasonic knife-curettes were fashioned which were designed for gingivoplasty and gingivectomy in human patients.[2] Again, observations were made that the clinical wound resulting from the excision of tissue had as one of its concomitants coagulation of the distal tissues removed from the wound bed. In order to better understand the character of this ultrasonically originated wound hamsters were selected for ultrasonic study and experimental investigation.

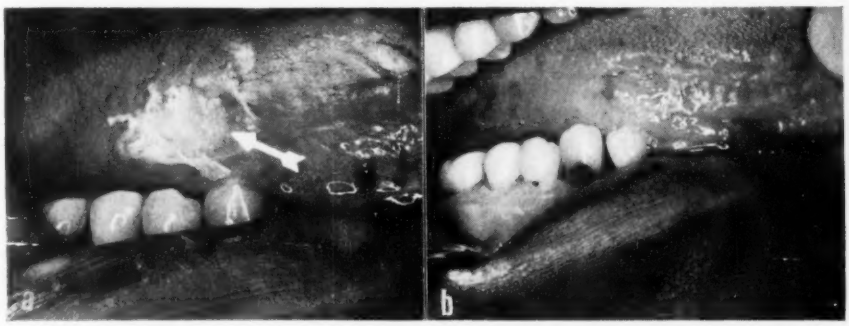

Fig. 1a. (arrow) Coagulation of lingual tissue created by ultrasonic tip pressed against the tissue for several minutes. 1b. Healed tissues one week later.

MATERIALS AND METHOD

Thirty hamsters, weighing approximately 125-140 grams each and having full permanent dentitions were selected. Fifteen hamsters were chosen for immediate sacrifice. A standard dental ultrasonic generator, which delivers approximately 25,000 to 28,000 vibrations per second was employed to create the ultrasonic wound. A tool-tip the size and dimensions of a standard periodontal probe, but square in cross-section was used as the cutting or coagulating tool. In three groups of five, the hamsters were anesthetized in a bell jar with ether. When anesthesia was complete, the right cheek was manually retracted and the gingival margin about the lower right first molar exposed to view. Setting the vibrating-tip in motion, with a good flow of water bathing the lower right first molar area, the gingival margin at the buccal aspect was rubbed continuously for five seconds in the first group of five, fifteen seconds in the second group, and thirty seconds in the third. All fifteen hamsters were immediately sacrificed and their mandibles removed, washed, and placed in 10% formalin.

A second group of fifteen hamsters were

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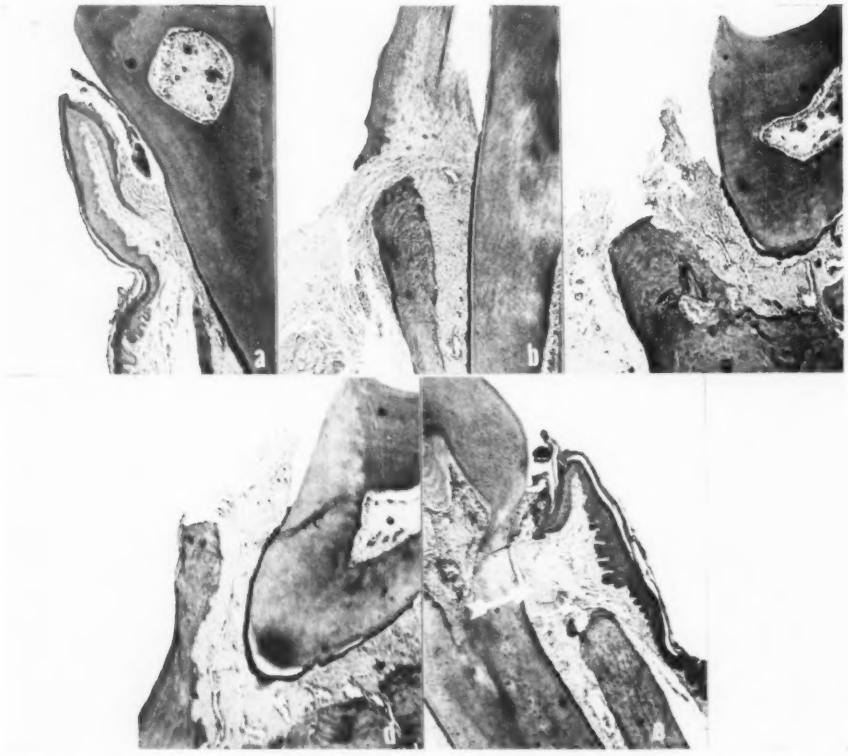

Fig. 2a. Control specimen—lower right first molar, mature Syrian hamster. 2b. Epithelial denudation following 5 seconds of ultrasonic rubbing. 2c. Epithelial denudation and disruption of the subjacent connective tissue after 15 seconds of ultrasonic rubbing. 2d. Epithelial denudation, disruption of subjacent corium with exposure of septal bone following 30 seconds of ultrasonic rubbing. 2e. (arrow) Complete regeneration of previously injured gingival tissues of Syrian hamster. (Ten days post-op.)

similarly treated for five, fifteen, and thirty seconds, but in this instance were revived and permitted to survive another ten days. At this time they were sacrificed and the mandibles were removed, washed and placed in 10% formalin.

Histologic preparation of both groups of hamsters' mandibles was performed. In this study only H&E sections of the lower right first molars will be described. Alternate sections are now being prepared for connective tissue and special stains.

CLINICAL FINDINGS

At the time of operation, after a few moments of continual stroking the marginal gingiva of the lower right first molar turned blue-white. As the tip continued to vibrate, the surface was shredded loose. In some instances active hemorrhage was initiated. The wound itself, however, did not bleed profusely.[3]

In the second group of fifteen hamsters, those which were sacrificed ten days postoperatively, the tissues were pinkish-grey and appeared clinically healed. No coagulation or injury was macroscopically visible in the lower right first molar area of any of the previously treated animals.[4]

MICROSCOPIC FINDINGS

IMMEDIATE SACRIFICE

Microscopic examination of histologic specimens from animals sacrificed imme-

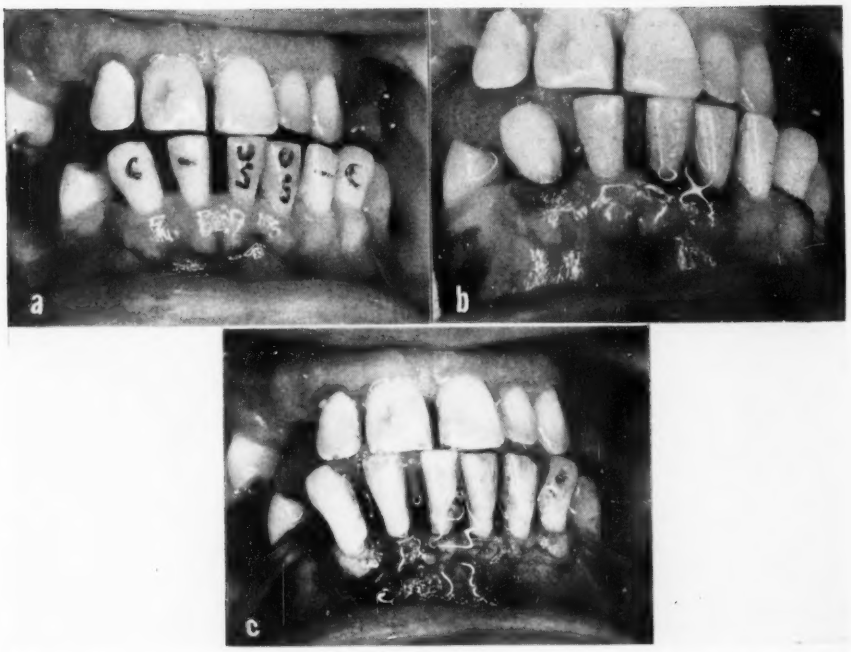

Fig. 3a. Human experimental tissues (labeled). Pre-op. 3b. Same patient immediately following ultrasonic scaling and curettage. 3c. Immediate gingivectomy for sectioning and microscopic study.

diately after ultrasonic wound follows:

Control specimen of the lower right first molar (figure 2A).

Five seconds ultrasonic wounding (figure 2B).

In this particular section the tissue removal and coagulation centered about the alveolar mucosa and the lower margin of the gingiva. In some instances the vibrating tip did not touch the papilla. The epithelium of the alveolar mucosa was completely removed by ultrasonic instrumentation; the edges of the wound were rounded off. The underlying corium and its collagen was fragmented and the surface shredded. Regularity of structure was absent; the wound had a completely disorganized appearance in the center affected by the ultrasound (arrow: figure 2B). A short distance from the center of fragmentation, the tissues appeared comparatively unaltered. The external cortical plate of the dental septum, the peridental membrane, and cementum were microscopically unaltered in appearance.

Fifteen Seconds Ultrasonic Wounding (figure 2C).

In this section the major focus of ultrasonic vibrations centered about the marginal papilla. Extensive loss of tissue and fragmentation resulted following fifteen seconds of direct application. The marginal papilla from the surface into the corium was completely disorganized; the coagulated tissues on the surface had probably been removed during the washing period preceding the placement into 10% formalin, the epithelium and epithelial were missing. The area from the underlying corium to the outer surface of the cortical bone appeared fused. The edges were shredded and fragmented.

Thirty Seconds (immediate sacrifice) (figure 2D).

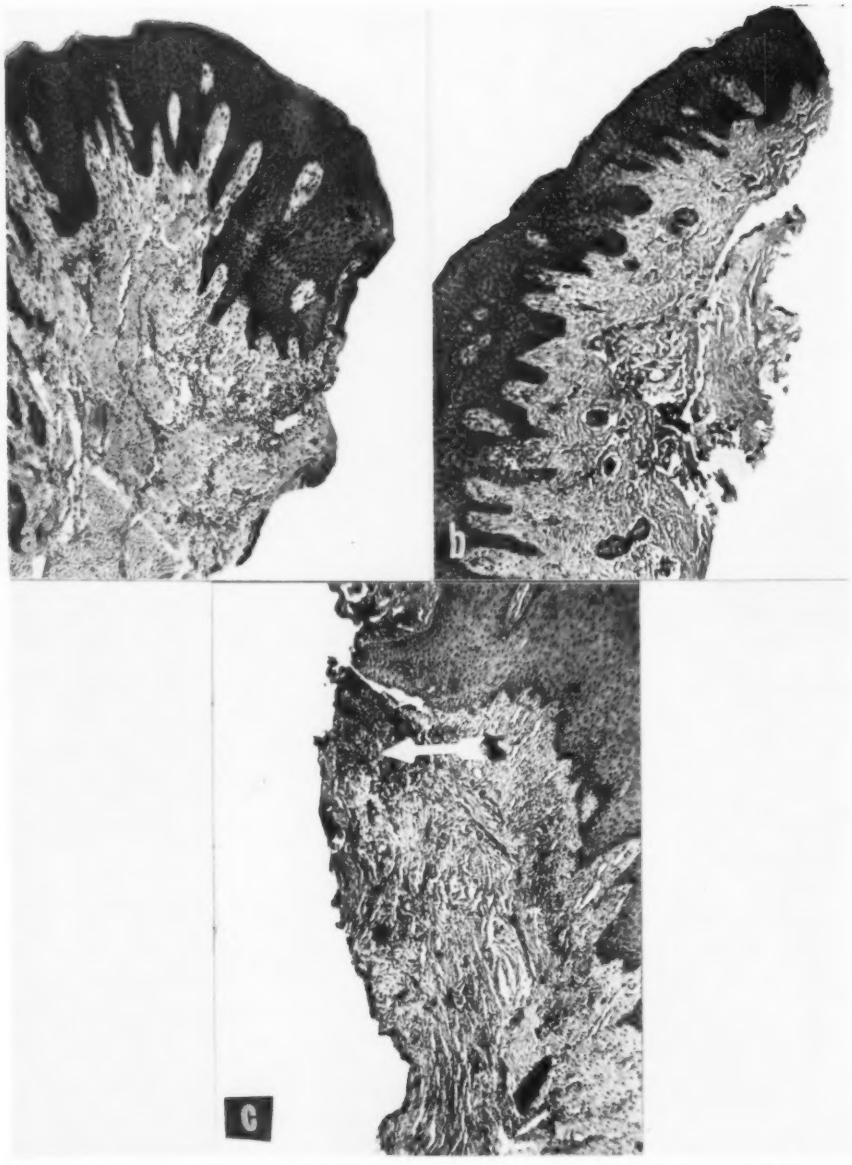

Fig. 4a. Control area. Lower right lateral and lower left lateral incisors (aforementioned human patient). Typical rete peg anastamosis with round cell infiltration in the corium. 4b. Immediately following hand curettage lower right three and lower left three. Crevicular epithelium and subjacent inflammatory infiltrate surgically removed. 4c. (arrow) Crevicular epithelium ultrasonically removed with simultaneous coagulation and fusion of the underlying connective tissue bundles.

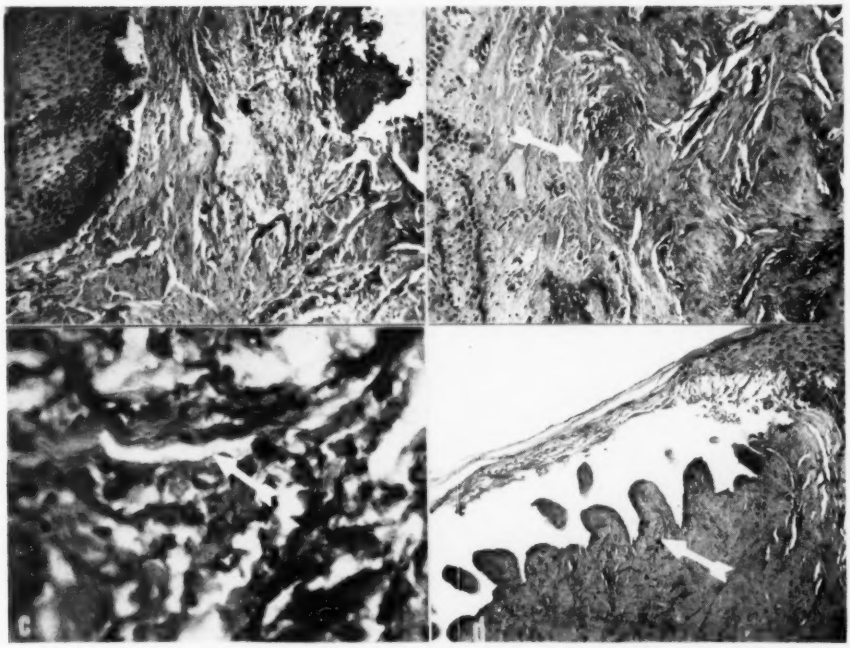

Fig. 5a. High power magnification ultrasonic wound (human). Disruption of collagen bundles with coagulation and slit formation. 5b. Specific line of demarcation between ultrasonically coagulated and normal-appearing tissue. 5c. Still higher magnification. Disruption of collagen bundles. Deformation of nuclei. 5d. Mechanical separation of ultrasonically treated epithelium from underlying connective tissue. Reticular papillae coagulated and fused.

Extensive denudation of the epithelium took place. The bone appeared stripped clean of overlying mucosa. The marginal papilla was missing. The corium originally under the marginal papilla was fragmented.

In all specimens of five, fifteen, and thirty second ultrasonic wounding, the tissue appeared to be mechanically pulled apart to a *specific* depth. Subjacent to the observed changes there was a clean demarcation between normal appearing tissue and altered tissue. One might speculate that ultrasonic vibrations of a given frequency and specific time of application seem to penetrate in direct proportion to these factors.

TEN DAYS POST-OPERATIVE

In the second group of fifteen hamsters, the gingival area around the lower right first molar was ultrasonically vibrated for five, fifteen, and thirty seconds. The animals were sacrificed ten days post-operatively.

As shown above (2D) the wound created by thirty seconds of continuous ultrasonic vibrations was most disruptive. A microscopic section of the healing of such a wound is presented (figure 2E).

At ten days the papilla was again intact; the wound area epithelialized the subjacent soft tissue reformed.

Well arranged collagen bundles covered the bone septum. The periodontal membrane and the cementum were normal in appearance. At no time was acute inflammatory infiltration noted in these sections.

HUMAN MICROSCOPIC SECTIONS

Simultaneous with this investigation of hamster gingiva, human patients were being treated for periodontal disease. A pa-

tient had gingival tissue excised from an individual papilla to segments involving as many as six teeth. The excision followed the ultrasonic vibration of crevicular areas.

MATERIALS AND METHODS

A patient requiring gingivectomy about the six lower anterior teeth was selected for ultrasonic wound study.

The lower right and left cuspids were treated with hand instruments and soft tissue curettage was performed.

The right and left lateral incisors were left alone.

The lower right and lower left central incisor areas were curetted with an ultrasonic instrument.

The teeth were marked for identification (figure 3A).

C = hand curettage
—— = control
US = ultra sound

These areas were treated (figure 3B) according to the above notation. A gingivectomy was performed (figure 3C); the tissues were divided, washed, and placed into three separate bottles of 10% formalin.

Control Papilla (figure 4A) (lower right 2 and lower left 2).

Microscopic examination revealed a marginal papilla and subjacent tissues with typical inflammatory infiltrate. The rete pegs are anastamosed and they lie deeper than usual following the pocket lining. This tissue which clinically was fibrotic showed dense collagen formation and a minimum number of blood vessels.

Hand Curetted Papilla (figure 4B) (lower right 3 and lower left 3).

Hand curettage has removed the crevicular epithelium as well as the greater portion of inflamed tissue.

Ultrasonically Curetted Papilla (figure 4C).

With ultrasonic curettage and lavage the crevicular epithelium was removed. The underlying corium showed typical fusion of collagen bundles and slit-like areas between them. The coagulated tissue on the surface stained darkly—simulating necrotic, or burned tissues.[5] (Orban—personal communication)—Since this section of tissue came from the distal portion of the wound, and had been removed from the site of excision there is as yet no material available on the microscopic character of healing in human gingiva following ultrasonic vibration.

Higher Magnification—Human Gingiva (figure 5A & 5B).

There was clear delineation between these tissues affected by ultrasonic coagulation and those immediately adjacent which were seemingly unaffected by the ultrasonic vibrations. (arrow 5B)

Under still higher magnification (400X) (figure 5C) the interstitial sections were empty. (arrow 5C) The collagen bundles were pushed apart and the fibers, in small groups, were curled up and knotted in appearance.[6] The nuclei of the fibroblasts were shrunken, hyperchromatic and very irregular in their shapes and sizes.

In some instances the coagulative process following ultrasonic vibration pulled epithelium from the connective tissue base leaving the reticular papillae standing upright (arrow figure 5D). In this section the collagen bundles were fused into a diffuse mass; all anatomical separation between the collagen bundles was lost.

DISCUSSION

Ultrasonic vibrations have both basic and secondary effects.[7] Sound energy absorbed at tissue junctions takes the form of heat. The mechanical action of ultrasonic periodontal tool-tips, by their rhythmic bumping, literally cooks or coagulates tissue at and near the site of application. When water intervenes between the tip and the tissue, it usually dispels most of the heat. Should the vibrating tip in gingival curettage purposely be pressed or rubbed

against tissue, the immediate result is a coagulative wound.

In the hamster the ultrasonic wound, produced by five to thirty seconds of direct contact and rubbing on the tissue, disrupted tissue continuity, lifted off epithelium, dismembered collagen bundles and altered the forms of the fibroblast nuclei. *Within a ten day period the hamster wounds uniformly healed and new collagen and epithelium regenerated.*

In similar experiments previously performed on hamster tongues, where the wound was created in depth, remains of the tissue disruption were visible after 7 days. The surface, however, was cicatrized and healed like any coagulated wound or burn.

In these various observations at no time was the ultrasonic tip permitted to lie directly against bone tissue as it vibrated. One might speculate that a deep burn or coagulation involving bone might create localized osteomyelitis and bone spicule formation.

SUMMARY

A series of microscopic slides illustrating the effects of a standard ultrasonic generator vibrated at 25 KC. against the marginal gingiva of the lower right first molar of thirty hamsters and against the crevicular gingiva of one human patient has been presented.

44 Grace Avenue, Great Neck, New York

The author wishes to express his thanks to Doctors Sidney Sorrin, Sigmund Stahl and Harry Blechman for their encouragement and guidance in this work.

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AMERICAN ASSOCIATION OF ENDODONTISTS

The annual meeting of the American Association of Endodontists will be held at the Fontainbleau Hotel at Miami Beach, Florida, February 11th through the 14th, 1962. The theme of the meeting will be "The biology of the apical and periapical tissues," featuring Drs. S. N. Bhaskar, Harry Blechman, D. Walter Cohen, Paul Goldhaber, Daniel Laskin, Maury Massler, Harry Sicher, and C. E. Wilde, Jr. as clinicians. The meeting is open to all members of the dental and allied professions.

The Pinsplint, a Removable Splint Fixation
A Modification of von Weissenfluh's "Hülsen-Stiftschiene"

by Erik Munch-Hansen, *Virum, Denmark*

In 1952 Hans von Weissenfluh, Lugano, Switzerland, published in the "Schweizerische Monatsschrift für Zahnheilkunde" a new form for removable splint fixation, called "die Hülsen-Stiftschiene." This form of fixation gives a very sturdy fixation of loosened teeth and at the same time forms a contrast to other types of removable splints, e.g. Elbrecht's splint, in that they are also satisfactory from the cosmetical point of view.

Instead of extradental fixation elements —such as, e.g., the claps and incisal hooks of the Elbrecht splint—von Weissenfluh places the fixation intradentally. For this purpose he employs tiny gold tubes that are furnished with a bottom and are cemented axially into the teeth, for incisors on the lingual surfaces, for the bicuspids and molars on the occlusal surfaces. Standardized gold pins fitting into the tubes are soldered on to the removable splint. In situ the splint locks the teeth tightly in a block and stiffens the individual teeth against horizontal stresses.

No gold is visible. If extraction of individual teeth should become necessary later on, they can easily be replaced by direct mounting on the splint.

The Clinical Procedure:

The location of tubes and splint are determined on study casts.

With a special cylindrical diamond drill (Fig. 1) the enamel is pierced at the spots where the tubes are to be inserted. The preparation is continued with a special bur and a special drill for enlarging the cavity (Figs. 2 and 3). The drills are equipped with a shoulder so that the operator can drill only to the required depth of the cavity; their thickness is equal to the outside diameter of the tubes, i.e. 0.95 mm. In order to avoid the risk of an excessive enlargement of the cavity, it is important that the drilling is halted (by the shoulder stop) immediately on reaching the cavity depth. Depth and width of the preparation can be checked up with a special measuring instrument (Fig. 4). Finally, the edge of the cavity is smoothed down with a round finish bur (Fig. 5).

All cavities for the tubes are drilled at the same time. The operator *may* make use of the various auxiliary instruments to ensure parallelism, though this should not be necessary. The tolerance is comparatively large on account of the fairly short pins. I have never used the mentioned instruments myself.

The cementing-in of the tubes can be undertaken when the cavities have been made dry. The tubes for incisors are cut off slantwise, the tubes for bicuspids and molars are cut off straight (Figs. 6 and 7). There are two types of tubes for incisors distinguishable by a more or less steeply sloping cut dependent upon the angle of inclination of the lingual surface as compared with the axial preparation. The tubes are placed on the flattened end of instrument I (Fig. 8), led into the cavity, pressed further up with the other end of I, whereupon the funnel-shaped orifice of the tube is smoothed with instrument II (Fig. 9).

These tubes are to be regarded as gold inlays, and the same high demands as regards burnishing and finishing of the rim jointing apply here, too. It is thus a "conditio sine qua non" that the edge jointing is perfect as caries may otherwise set in at the joint.

After the final polishing of the tubes a careful alginate impression is taken in the usual way. The location of the tubes in the teeth can be seen in this impression and is reproduced again in the model plaster

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Fig. 4

Fig. 6

Fig. 7

Fig. 10

Kavitetspræparation til hylstre:

Fig. 1

ad Fig. 1

Fig. 2

ad Fig. 2

Fig. 3

ad Fig. 3

Fig. 5

ad Fig. 5

Indcementering af hylstre:

ad Fig. 8

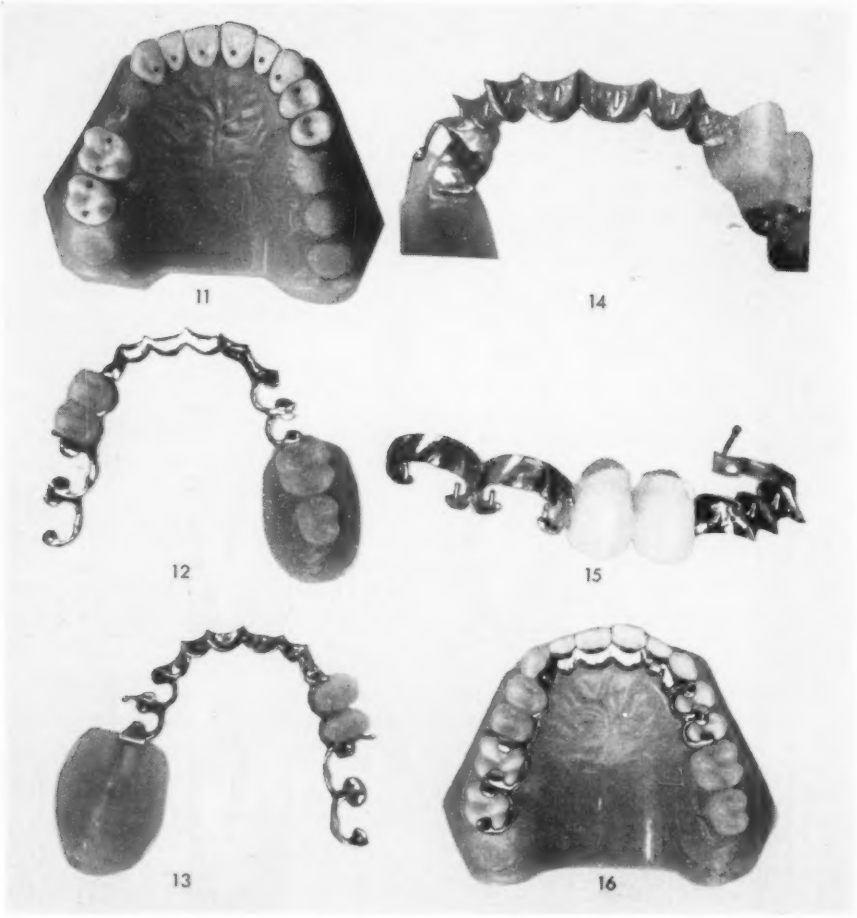
ad Fig. 8

ad Fig. 9

Fig. 8

Fig. 9

Preparation of cavity for tubes. Cementing-in of tubes.



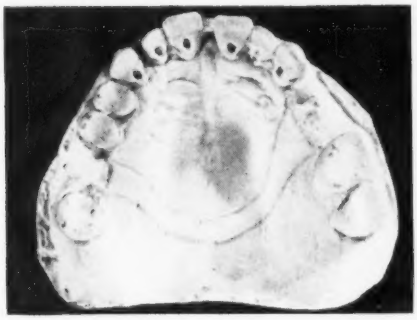
Note in figs. 12 and 13: The free-end saddle is connected with the von Weissenfluh splint by means of a Fischer attachment.

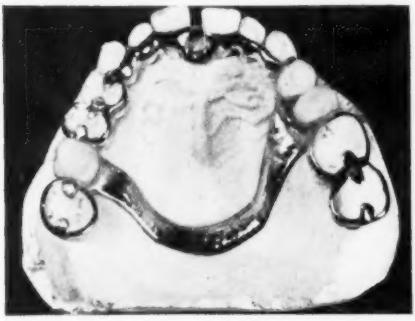
cast. The splint is cast in either gold or a chromium-cobalt alloy and is tried on in the mouth with the holes in the splint corresponding to the orifices of the tubes. The gold pins (Fig. 10) are led through these orifices up into the tubes, and with pins in situ a small impression is taken in a thermoplastic material, e.g. Kerr green-stick modeling compound, which covers only the splint with the placed pins. After cooling, the splint, with the pins now fixed in the impression compound, is removed. The pins are soldered on; the splint is given a repolish; teeth, if any, are mounted; and the splint is ready for delivery (Figs. 11-16).

The Pinsplint:

This form of splint, a combination of the Elbrecht splint and the von Weissenfluh splint, is a modification of the above-mentioned original "Hülsen-Stiftschiene."

The von Weissenfluh splint covers a rather large part of the lingual surfaces. I have made the following modifications in





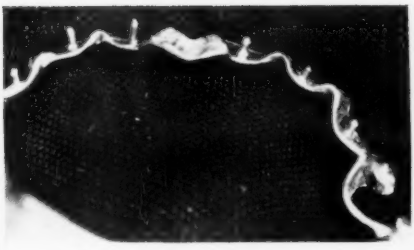


Fig. 17 (above) Fig. 18 (below) Fig. 20 (above) Fig. 21 (below)

Fig. 19

Figs. 17, 18, 19, 20 and 21: Model photos of the principle governing the construction of pinsplint coincident with replacement of 6+4,5. Material: Gold + Acrylic.

consequence of the opinion that the larger the surface of contact of splint against tooth, the greater will be the possibility of retention of food debris and, consequently, the risk of caries:

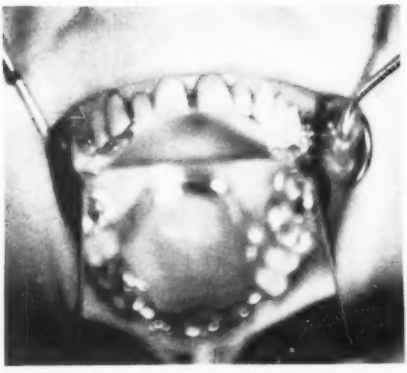
The splint is only very slightly wider than an ordinary continuous clasp appliance. As this weakens the strength of the splint, especially against torsional or bending stress when the splint is not in place in the mouth, the side segments are connected by a palatal bar appliance.

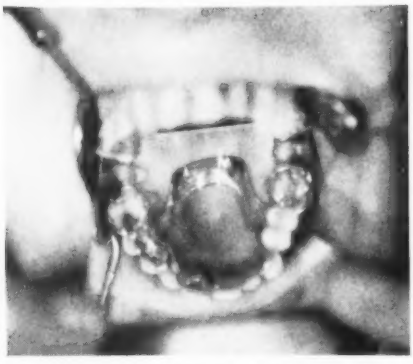
As a further simplification of the construction and in order to avoid insertion of tubes in filled molars and premolars, I have for the last five years made my splints as a combination between an Elbrecht splint in the premolar and molar region and a von Weissenfluh splint in front from 3+ to +3 inclusive (Figs. 17-26).

In my opinion the result is a removable form of splint which

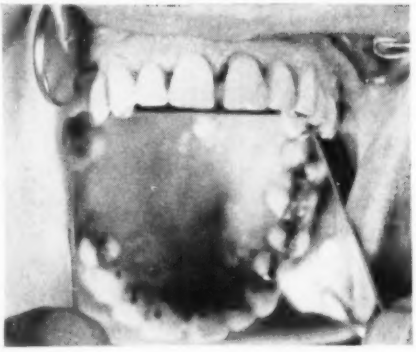
(1) stabilize loosened teeth very effectively,

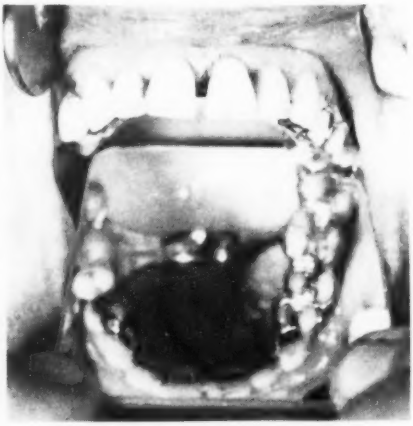
(2) does not present greater risk of





Figs. 22, 23 and 24: Mouth photographs of the same case as that of Figs. 18 and 19.





Figs. 25 and 26: Pinsplint with coincident replacement of 6,5,4+ (1 + replaced immediate). Material: Vitallium and Acrylic.

caries than any other removable partial denture or parodontitis splint,

(3) is cosmetically satisfactory, and

(4) technically is comparatively easy to make on account of its simple design.

As in the case of any other removable partial denture or splint stabilization—and especially, of course, in the case of patients with marginal parodontopathies—it is imperative both that the patient is thoroughly instructed in effective care of his own teeth, and that the dentist checks up regularly to see if the mouth hygiene is satisfactory.

Indications and Contraindications:

The pinsplint is suitable primarily for fixation of teeth in the upper part of the mouth. Its application is indicated in all cases where it is desirable to fix teeth by means of a removable splint. Inset saddles can be placed direct on the splint. Free-end saddles can be attached to the splint by

means of a suitable articulation attachment. The retention principle of pin plus tube is likewise applicable where an invisible, active retention of partial dentures in the frontal region is desirable for cosmetic reasons.

Contraindications: The mentioned removable splint fixation should not be used in any set of teeth with a high caries activity. No decision on a prospective splint fixation should be taken until this matter has been investigated closely, for instance by obtaining information of the caries frequency over a suitable period of time. The outcome of the investigation of caries activity in conjunction with the dentist's conception of the patient's capability for an effective personal care of his teeth must invariably enter into the decisive factors regarding the application of a removable splint fixation.

Summary:

A detailed description of the von Weissenfluh splint is given. The pinsplint, a modified combination of the Elbrecht splint and of the von Weissenfluh splint principle, is discussed in details. The author mentions the problem of countering the risk of caries proceeding from either tubes or the splint proper. Indications and contraindications are stated.

The pinsplint is a removable, cosmetically successful and effective splint fixation particularly suitable for teeth in the upper jaw. On account of its simple design the pinsplint is fairly easy to make.

Résumé français:

Une description détaillée de l'attelle von Weissenfluh est donnée. L'attelle à pivots, combination modifiée de l'attelle Elbrecht et du principe de l'attelle von Weissenfluh, est exposée en détails. La question des risques de carie provenant des douilles ou de l'attelle même est traitée ainsi que la possibilité d'y parer. Indication et contre-indication sont données.

L'attelle à pivots est une fixation amovible, effective et, d'un point de vue cosmétique, heureuse qui s'adapte tout particulièrement aux dents de la mâchoire supérieure. Grâce à sa conception peu compliquée, l'attelle à pivots est assez facile à exécuter.

I, Virum Torv, Virum, Denmark

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TUFTS UNIVERSITY SCHOOL OF DENTAL MEDICINE

The increasing awareness of the importance of gingival disease has created the need for a clearing house for the histopathologic evaluation of diagnostic and treatment problems. To meet this need, the Department of Periodontology of Tufts University announces the establishment of a registry of gingival disease. Practitioners are invited to submit gingival biopsies for diagnosis. Additional pertinent information will be provided by the registry regarding the nature of individual cases. Permanent files will be maintained for follow-up case study.

Necessary forms and mailing containers will be sent on request. There is no charge for this service. For further information, write to the Department of Periodontology at Tufts University School of Dental Medicine, 126 Harrison Avenue, Boston 11, Massachusetts.

Studies on Periodontal Diseases in the Mouse
IV. The Effects of a High Protein, Low Carbohydrate Diet

by PAUL N. BAER* AND CARL L. WHITE,** *Bethesda, Md.*

HIGH protein diets have been recommended for weight reduction during pregnancy,[1] for patients both pre and post-operatively,[2,3] for patients with severe burns,[4,5] for hemoglobin building,[6,7] and for wound healing.[8,9] The salutary effects of high protein diets in wound healing have not been confirmed in a recent investigation.[10] This study is concerned with the effects of a high protein, low carbohydrate diet on the severity of the periodontal lesion as it occurs naturally in the susceptible strain of mouse STR/N.[11,12]

METHODS AND RESULTS

Part A. Two groups of STR/N mice, both males and females, were used in this experiment. They were housed in plastic cages, 5 per cage, and maintained in a similar environment. The animals in one group, Group I, were maintained on a Purina Laboratory diet from weanling to 260 days of age. The other group, Group II, were fed Purina Laboratory Chow for 170 days, and then placed on a high protein diet, Diet 111, table 1, for an additional 90 days. The Purina diet contains 25% protein and 50% carbohydrate.

The sex and number of animals in each group are shown in table 2. At the time of sacrifice, the heads were removed, defleshed by the papain method, and scored for alveolar bone loss according to a method previously described.[11]

TABLE 1
Composition of Diets 111 and 112

HMW salts	4%
Liver powder	5%
B. Yeast	3%
Alphacel	5%
Crisco	8%

Diet 111 contained 62% casein and 13% sucrose while Diet 112 contained 25% casein and 50% sucrose.

The results, table 2, indicate that the animals on the Purina Laboratory diet had the more severe alveolar bone loss. The differences are statistically significant.

Part B. Purina Laboratory Chow differs from the high protein diet, Diet 111, not only in its physical consistency, but also in its ingredients. For instance, the source of protein for our Diet 111, is casein, while in Purina Laboratory Chow the main sources of protein are meat and bone meal,

TABLE 2
Comparison of Periodontal Scores with the Standard Errors

Diet Regimen	*No. of mice*	*Periodontal Score*
Group I (Purina Lab. Chow for 260 days)	38	14.8±0.60*
Group II (Purina Lab. Chow for 170 days, then high protein diet for 90 days)	40	9.2±0.36
Stock (Purina diet, 260 days)	37	14.8±0.60
Purina 170 days, Diet 111, 90 days	50	9.1±0.56
Purina 170 days Diet 112, 90 days	55	13.5±0.62

*Standard error.

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fish meal, dried skimmed milk, wheat germ meal, and soybean meal.

Therefore, we decided to repeat the above experiment with an additional control, Diet 112, table 1. This latter diet is of the same physical consistency and contains the same ingredients as our high protein diet, but differs from it only in the percentages of protein and carbohydrates which it contains. At the same time, Diet 112, contains the same percentages of protein and carbohydrate as does the Purina Laboratory Chow.

Weanling STR/N mice of both sexes were divided into the following 3 groups: Group I consisting of 37 animals, was fed Purina Laboratory Chow for 260 days. Group II, consisting of 50 animals, was fed the Purina diet for 170 days, and then placed on Diet 112, our semi-purified control diet, for an additional 90 days. Group III, consisting of 55 mice, was fed the Purina diet for 170 days, and then placed on the high protein diet, Diet 111, for an additional 90 days. The animals were all sacrificed at the end of 260 days, and the jaws and teeth prepared and scored for alveolar bone loss as in Part A above.

The results, table 2, demonstrated once again, that the animals fed the high protein diet, Diet 111, had a reduction in alveolar bone loss. The differences between the Stock and semi-purified control diets as compared to the high protein diet, Diet 111, are statistically significant.

DISCUSSION

The decrease in the loss of alveolar bone which occurred in the group of animals fed a high protein diet, as compared to those maintained on the commercial Purina Laboratory diet, or the semi-purified control diet can be interpreted in several ways. Either the presence of the high percentage of the protein was actually preventative, or else the results were due to the low amount of carbohydrate. The work of Auskaps[12] and Gupta[13] is suggestive that a high carbohydrate diet may cause increased loss of alveolar bone. On the other hand, we have shown, in previous work from our laboratory,[11,14] that a diet which contains no carbohydrate at all is still capable of producing severe alveolar bone loss. The importance of the protein in the diet, therefore, should not be underestimated. Cannon[15] for instance, has stressed the importance of adequate protein in the diet for preservation of the antibody mechanism in disease resistance. This might, in part at least, explain why the high protein diet had the ability to lessen the degree of alveolar bone loss. It is also possible, however, that strains of mice which are susceptible to periodontal disease might have different physiologic needs for certain amino acids. In feeding diets which contain a high level of protein, the differences in the amino acid composition of the diet becomes less critical. To state this another way: when high levels of protein are fed, the differences between proteins of differing biologic value is less marked.[16]

Another explanation which must also be considered is that a high protein intake increases both absorption and retention of calcium.[17,18,19] The implications of this are obvious.

Studies are in progress which will attempt to elucidate some of the problems posed by this investigation.

CONCLUSIONS

A diet containing 62% protein in the form of casein, when fed to STR/N mice, resulted in a statistically significant reduction in alveolar bone loss. The explanation for this phenomenon has not been determined.

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UNIVERSITY OF PENNSYLVANIA

The University of Pennsylvania School of Dentistry announces the following postgraduate courses:

Dr. Jens J. Pindborg of Copenhagen, Denmark, will present a two-day course on Dermatologic Lesions with Oral Manifestations on November 27 and 28, 1961. This course will include a discussion of almost all dermatologic lesions showing oral manifestations.

Drs. Henry M. Goldman and D. Walter Cohen will present a one-day course on The Use of Ultrasonics in Periodontia on Saturday, December 16, 1961. The development of ultrasonics for the removal of supra and subgingival calculus deposits has proven to be an aid in periodontal therapy as well as routine prophylaxis. The course will encompass the principles of ultrasonics and the tissue reaction to these instruments.

Drs. Henry M. Goldman, D. Walter Cohen and Frederic M. Chacker will present a course on Periodontal Histopathology January 8 to 12, 1962. The purpose of this course is to acquaint the practitioner with the tissue changes occurring in the various periodontal manifestations so that he will have an understanding of the objectives of therapy.

For further information please write Postgraduate Courses, School of Dentistry, University of Pennsylvania, 4001 Spruce Street, Philadelphia 4, Pennsylvania.

Inhibition of Dental Calculus Formation by Use of an Enzyme Chewing Gum*

by J. ENNEVER, D.D.S., M.S., AND O. P. STURZENBERGER, D.D.S., *Cincinnati, Ohio*

THIS study was conducted in order to determine what effect the use of a chewing gum containing a specific pancreatin preparation** would have on dental calculus formation in a group of subjects selected for their ability to develop calculus.

Arthur Jensen has reported that a Viokase powder was effective in decreasing the amount of calculus present in his subjects.[1] They held the powder in their mouths for 10 to 15 minutes once each day. After six weeks Jensen found that the people had less calculus than when they had started. We repeated this form of use on a small group of calculus-forming subjects who started the test calculus-free. Our findings supported Jensen's conclusions. Under the conditions imposed, Viokase seemed to be an effective anti-calculus agent. However, even though this particular mixture of enzymes appeared to have merit, most of our subjects objected to the taste, texture and odor. All objected to the method of use. The problem to be resolved was the development of a suitable vehicle in which the pancreatin would be stable and which would allow sufficient contact time for the active agent to be effective. Chewing gum was chosen. Typical use of such a vehicle would provide adequate contact time for the enzyme mixture to perform its function. In addition since chewing gum is a relatively simple product, chances of incompatabilities among ingredients would be at a minimum.

MATERIALS AND METHODS

The test product was a modification of a commercially available chewing gum. The Viokase was added as the last step in the mixing process during which the temperature was held at 45° C. The concentration of pancreatin in the gum was approximately 1.5 per cent. A chewing gum without the enzymes but with the same flavor and texture as the test product was prepared for use as the control. Both test and control were distributed in plain-wrapped, coded packs.

The experimental design was the split-panel test, recently suggested as being suitable for the clinical evaluation of anti-calculus materials.[2] Subjects were selected who had histories of excessive calculus formation. Each received a thorough dental prophylaxis and was assigned either test or control gum. To achieve random distribution of products, a coin-flip was used to determine assignment by pairs. The subjects were instructed to chew one pack of gum per day and to chew each of the five sticks for five minutes. After 8 weeks the subjects were graded for the occurrence of calculus by the Calculus Surface Index method.[3] Each subject received a second prophylaxis and was provided with his alternate product. At the end of the second period of 8 weeks all participants were again graded.

The prophylaxes were performed by a dental hygienist. All the grading was done by one dentist. He did not know which chewing gum had been used by any of the subjects. The findings were recorded by a clerk and the grader saw none of the scores until the study had been finished.

RESULTS

Nineteen subjects completed the full program. Their Calculus Surface Index scores are given in Table I. For the group, the reduction in the occurrence of dental calculus was approximately 24 per cent. This effect was statistically significant at

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**Viokase, VioBin Corporation, Monticello, Illinois.

TABLE I

Calculus Surface Index Scores in Split-Panel Clinical Test of an Enzyme Chewing Gum

Subject	*Control Score*	*Test Score*	*C-T*
A*	10	7	3
B	5	6	−1
C*	9	3	6
D*	0	0	0
E	5	6	−1
F	6	6	0
G*	3	4	−1
H*	3	1	2
I	2	5	−3
J*	12	6	6
K	9	9	0
L	6	4	2
M*	12	6	6
N*	11	10	1
O*	8	5	3
P	8	6	2
Q	6	3	3
R*	2	1	1
S*	12	10	2
Totals	129	98	31
Means	6.79	5.16	1.63

*=subject used control gum during first period

the 0.01 level of probability. The analysis of variance is given in Table II.

There was no evidence, either subjective or objective, of mouth irritation related to use of the experimental gum.

DISCUSSION

The dynamics of dental calculus formation involves the development of a plaque on a tooth surface, the seeding of mineral crystals within the plaque and the maturation of the deposit by further calcification. We believe that the enzyme chewing gum exerts an effect on calculus formation by contributing to an alteration of the nonliving components of the calculus plaque. This, in turn, interferes with the progress of mineral seeding and maturation phases. The intra-oral use of enzymes for inhibiting dental calculus is not new. The work previous to that of Jensen has been covered in Everett's excellent review.[4] Unfortunately, the early investigations never progressed beyond the very preliminary level.

This study has raised several issues that need to be resolved. The concentration of active ingredient in the chewing gum is 1.5 per cent. This is probably higher than necessary. The subjects chewed 5 sticks per day and chewed each stick for 5 minutes. We do not know that this is the best routine. The mean difference between control and test scores for the subjects who used control gum during the first period was 2.7 surfaces. The mean difference for those who started with test gum was 0.3 surfaces. This suggests a carry-over effect by the test product and, if real, will require a different test design for future clinical investigations involving enzmye preparations.

SUMMARY

The use of a chewing gum containing the pancreatin, Viokase, reduced the occurrence of dental calculus for a group of 19 calculus-forming subjects by 24 per cent in a split-panel test. The effect was statistically significant at the 0.01 level of probability.

TABLE II
Analysis of Variance

Source of Variation	df	SS	MS	F–Tests	F	.01
Corr. Total	43	419.3680				
Products	1	23.1275	23.1275		8.93	8.3
Periods	1	15.4821	15.4821		5.98	8.3
Groups	1	1.6421	1.6421		0.08	8.3
Subjects W/In Grs.	17	335.0909	19.7112		7.61	3.0
W/In Subjects	17	44.0254	2.5897			
Missing	6					

Further work is necessary to determine the level of effectiveness that can be achieved under optimum conditions of formulation, use and evaluation.

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Analysis of Desensitization of Dentin by Sodium Silico-fluoride and Gottlieb's Solution by use of Radioactive Silver Nitrate

by GROVER C. HUNTER, JR., D.D.S., M.S., MARTIN BARRINGER, D.D.S., M.S., AND GEORGE SPOONER, PH.D., *Chapel Hill, North Carolina**

THIS pilot experiment was conducted to test by means of $Ag^{111}NO_3$ the possible effectiveness of blockage of dentin by topical application of Na_2SiF_6 and $Zn_2Fe(CN)_6$ (Gottlieb's solution). Since these medicaments have been tentatively accepted for clinical usage as desensitizing agents, more than subjective clinical evidence of effectiveness is desirable. In this study it was assumed that desensitization of dentin depends upon the degree of blockage of the dentinal tubuli, according to Gottlieb.[1] Theories of the mechanics of blockage include: (1) the impregnation of water insoluble compounds, (2) precipitation of protoplasm of the dentinal fibril, or (3) a combination of (1) and (2). Current opinion seems to favor theory (1) above for the mechanism of blockage by Na_2SiF_6, although the true nature of blockage is unknown.[4]

Massler[4] and Stout reported satisfactory clinical results using Na_2SiF_6, the measure of effectiveness being the patient response to treatment. Boyd[6] reported that in areas of dentinal sclerosis, there is less uptake of the isotope than in non-sclerotic areas of dentin. On the other hand, Bartlestone[2a] stated that although secondary dentin once appeared impermeable it has now been shown to be at times more permeable than primary dentin to the very sensitive tools of radiobiology. From our own work we found a tremendous difference in autographs made on extracted teeth where Na_2SiF_6 and $Zn_2Fe(CN)_6$ were applied prior to extraction in comparison with topical application of the medicaments on teeth after extraction.

Wainwright[2] asserts that radio-autographs are more sensitive than the most delicate chemical tests and are excellent for tracing the very small amount of radioactive isotope involved in uptake of highly calcified dental structures. Silver nitrate has excellent penetration power into normal dentin and eventually reaches the pulp.[3] Radioactive $Ag^{111}NO_3$ contains a desirable amount of beta radiation for radio-

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autographs with a minimum of the undesirable gamma radiation.[9]

EXPERIMENTAL

A total of 12 teeth condemned for periodontal reasons from 6 patients in the UNC Dental Clinic were selected for a single topical application of Na_2SiF_6 or $Zn_2Fe(CN)_6$. A questionnaire containing pertinent questions for each patient related to the use of fluorides in the drinking water or in dentifrices, and to the use of dentifrices containing other desensitizing agents.

Selected teeth were prepared and solutions of $Zn_2Fe(CN)_6$ and Na_2SiF_6 (as recommended by Stout[5]) were applied topically. The teeth were extracted 15-30 minutes later, washed, placed in isotonic saline solution, and refrigerated at 5°C. Because of a delay in the continuation of the study, the teeth were stored from 3-4 weeks, the saline being replaced with a fresh solution every 4-5 days.

Laboratory procedures for treating the teeth with $Ag^{111}NO_3$ and sectioning are as follows:

1. Washed in running tap water for 20 minutes
2. Washed in distilled water for 20 minutes
3. Blotted dry with paper towels
4. Placed in $Ag^{111}NO_3$ for 5 minutes (2 millicuries of $Ag^{111}NO_3$ received from O.R.N.L., Oak Ridge, Tenn.)
5. Placed in 10% formalin for 10 minutes
6. Placed in distilled water for 2 minutes
7. Placed in ethyl alcohol for 2 minutes
8. Blotted dry with paper towels
9. Embedded in Castolite (an autopolymer)
10. Sectioned under water in "dry box," using a gem stone cutter

Fig. 1. (A) Maxillary right lateral incisor embedded and sectioned in Castolite, showing heavy abrasion on the lingual and incisal surfaces.

Fig. 1 (B). Autograph of same tooth in Fig. 1 (A) showing uptake of Ag^{III} NO_3. Na_2 Si F_6 was applied to the lingual surface only.

Fig. 2. (A upper) Maxillary right central incisor embedded and sectioned in Castolite, showing heavy abrasion on the lingual and incisal surfaces.

Fig. 2. (B lower) Autograph of tooth above showing uptake of Ag^{III} NO_3. Na_2 Si F_6 was applied to lingual surface only.

TABLE I
Blockage of Dentinal Tubuli Using Na_2SiF_6 and $Zn_2Fe(CN)_6$ on Human Teeth

Slide	Patient No.	Tooth	Treatment	Test Area	Results of Blockage
4	5	$\underline{3/}$	$Zn_2Fe(CN)_6$ ppt. on all surfaces preceded by a benzene wash	Exposed dentin on incisal	++
5	5	$\underline{/1}$	"	Exposed dentin on incisal	+++
15	5	$\underline{1/}$	"	What appeared to be intact enamel was penetrated	+
19	5	$\underline{/3}$	"	Erosion on labial; enamel and cemento-enamel junction	+++
2	6	$\overline{2/}$	$Zn_2Fe(CN)_6$ ppt. on all surfaces (no benzene wash)	Erosion on labial	+
11	6	$\overline{/5}$	"	Erosion on buccal	+
12	6	$\overline{1/}$	"	Abraded incisal	+
11	6	$\overline{/2}$	"	Abraded incisal	+
20	6	$\overline{/4}$	"	Erosion on buccal	++
9	1	$\underline{1/}$	Na_2SiF_6 ppt. only on labial (no benzene wash)	Abrasion on lingual penetration of incisal by isotope where no impregnation treatment was made	++++
17	1	$\underline{2/}$	"	Abrasion on lingual penetration of incisal by isotope where no impregnation treatment was made	++++
7	1	$\overline{/1}$	"	Tissue flapped back on labial; penetration gum-line is much less than that of untreated lingual; incisal dentin penetrated	++++

\+ Poor or no blockage
++ Fair blockage
+++ Good blockage
++++ Excellent blockage

Radioautographs were made as suggested by Wainwright[2] and photographs were taken of the tooth sections. For the safety and protection of all concerned and for proper disposal of contaminated radioactive materials, methods were employed which complied with the standards set by the Atomic Energy Commission.

FINDINGS

The findings are tabulated in Table I. The results on three teeth of the two patients with topical application of Na_2SiF_6 were consistent and indicate a strong suggestion of the effectiveness of blockage. In Fig. 1 (A & B), maxillary right lateral incisor with heavy abrasion on lingual and incisal surfaces, to which Na_2SiF_6 was carefully applied only on the lingual surface, shows penetration of $Ag^{111}NO_3$ of exposed dentin on the incisal in the autograph, whereas the isotopic uptake on the exposed dentin of the lingual was similar to uptake on the labial intact enamel and considerably less than that of the incisal. Note the relatively heavy uptake of the carious lesion on the labial and on the cementum and soft tissue tags on the root.

In Fig. 2 (A & B) a maxillary right central incisor from the same patient as in

Fig. 1, with heavy abrasion on lingual and incisal surfaces to which Na_2SiF_6 was carefully applied to lingual surface only, shows in the autograph a heavy uptake in the exposed dentin and carious lesion on the incisal and cementum of the root, whereas the exposed dentin on the lingual surface where application of Na_2SiF_6 was made, shows no more uptake than the intact labial enamel.

Table I shows the results obtained on 9 teeth from 2 patients, where topical application of $Zn_2Fe(CN)_6$ was made in similar manner. The results were not as consistently effective for blockage; however, the benzene wash prior to application of $Zn_2Fe(CN)_6$ gives better results.

In another set of experiments on 58 collected extracted teeth, applying five different desensitizing medicaments, the results were very unpredictable and inconsistent, substantiating the findings of Wainwright[8] on 13 teeth in 1951.

DISCUSSION

As stated before the exact mechanism of blockage of dentinal tubules by Na_2SiF_6 or $Zn_2Fe(CN)_6$ is not known. In the case of Na_2SiF_6 the strong affinity of the fluoride ion is demonstrated by the increased fluoride content in bones buried in the ground, where water containing fluorides pass over them. The large silica atom attached to fluoride in the form of $SiF_6^{=}$ ion may plug the tubules mechanically, which could in effect be merely a surface phenomenon involving very little penetration of the $SiF_6^{=}$ ion.

SUMMARY

Seventy teeth, 12 pre-extraction treated and 58 post-extraction treated with various desensitizing agents were studied for blockage of dentinal tubules by use of $Ag^{111}NO_3$. The samples of pre-extraction-treated teeth gave the more consistent and predictable results, suggesting the possibility of superior blockage by Na_2SiF_6; however, the sample is too small to establish firm trends from this pilot experiment. Further investigation in this field utilizing a larger sample is needed to clarify the results before any conclusions can be drawn.

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ALBERT EINSTEIN COLLEGE OF MEDICINE YESHIVA UNIVERSITY

Albert Einstein College of Medicine of Yeshiva University announces a participation course in periodontics (DPD 66) for ten Wednesdays, commencing February 28 through May 2, 1962 presented by Dr. Marvin N. Okun, Dr. Irving Yudkoff and Associates. The fee will be $225.00.

For further information please write Director, Postgraduate Dental Program, Albert Einstein College of Medicine, Yeshiva University, Eastchester Road and Morris Park Avenue, Bronx 61, New York.

Histochemistry of the Gingiva

VI. Distribution and Localization of Phosphorylase*

by GIULIANO QUINTARELLI** AND EMANUEL CHERASKIN, *Birmingham, Alabama*

AMONG the group of homopolysaccharides, glycogen represents the most important highly polymerized carbohydrate in animal tissue. Its synthesis from glucose-1-phosphate (Cori Ester) is accomplished by the action of two different enzymes, namely phosphorylase and a branching enzyme,[4] i.e. the amylo 1,4→1,6− transglycosidase[7] (Q enzyme[6]). The polysaccharide formed from glucose-1-phosphate by the enzyme phosphorylase alone resembles amylose in that the glucose residues are arranged in a linear fashion like the amylose chain, their sole linkage being alpha −1,4. Amylo 1,4→1,6−transglycosidase is the enzyme responsible for the formation of the branching chains of the glycogen molecule or of amylopectin in such a manner that the alpha 1,6 linkage is formed from an alpha −1,4 link.

This paper deals with the localization and concentration of phosphorylase in human gingivae. The distribution of the enzyme in the gingival tissue could also be regarded as indirect evidence for the distribution of glycogen in the gingival mucosa.

MATERIALS AND METHODS

Twelve gingival specimens were obtained from patients undergoing blood glucose-tolerance tests. Block anesthesia was used in order to maintain the normal tissue metabolism and a partial gingivectomy of the labial mucosa in the upper right quadrant was performed. The age of the patients varied from 16 to 50 years; sex and race were not taken into consideration.

Experimental Procedure: Immediately upon removal, specimens were cut into blocks of 2 or 3 mm. in thickness, frozen on dry ice and mounted on the cryostat set at −20°C. Sections were then cut 6 to 10 micra thick and mounted on clean slides. After drying, sections were immersed in the incubating mixture of Takeuchi and Kuriaki.[9] This consisted of 50 mg. of glucose-1-phosphate, 10 mg. of muscle adenylic acid, 15 ml. distilled water, M/5 acetate buffer at pH 4.8, and 15 units of insulin. Furthermore, about 5 mg. of water-soluble glycogen was added to the mixture to act as a "primer." The solution was preheated to 37° C for 30 minutes. Sections were then incubated for 10, 20, 40 and 50 minutes. After incubation the sections were rinsed in a large volume of dilute Lugol's iodine solution (10 ml. Lugol's solution, U.S.P. in 190 ml. distilled water) (I_2:K_1:H_2O; 1:2:400) for five minutes. Finally, the sections were mounted with glychrogel alone or glychrogel containing a few drops of concentrated Lugol's solution. The sites of phosphorylase activity appeared blue black.

By means of this histochemical method two different staining reactions may be seen in the gingival mucosa. One, stained dark blue by iodine, represents the new polysaccharide synthesized from glucose molecules by phosphorylase. The other, stained light brown, demonstrates the pre-existing glycogen in the tissue (Figure 1). This difference in color thus helped to distinguish between the newly formed polysaccharide and the native glycogen present in the gingiva.

Control Procedure: Three different controls were utilized. In one, the sections were immersed in the incubating solution without the substrate, glucose-1-phosphate. The second control consisted of placing sections directly into dilute Lugol's solution (5 ml. Lugol's solution, U.S.P.; 95 ml. distilled water) for the demonstration of na-

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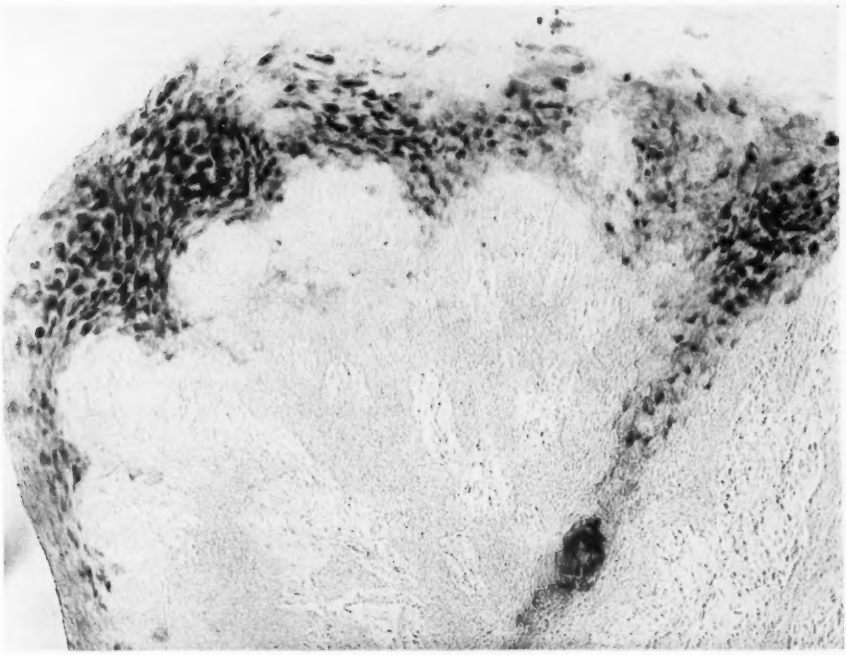

Fig. 1. Irregular localization of phosphorylase in dark black, while the native glycogen appears in dark grey. Note a small reactive parakeratotic pearl at the bottom of the picture.

tive glycogen. For the third control, rat tongues were employed since striated muscle contains large amounts of phosphorylase.

RESULTS

The distribution and localization of phosphorylase in the gingiva appears in selective points of the epithelial layer (Figure 2). Some rete pegs show a definite enzymatic reactivity while others, even though immediately adjacent, are completely devoid of the enzyme. In all cases, phosphorylase was distributed in the stratum spinosum and often in the stratum granulosum. However, none was demonstrated in the stratum germinativum. The keratotic layer did not react toward the enzyme (Figure 3). The crevicular epithelium was often strongly reactive (Figure 4) whereas the epithelium of the attached gingiva was, in most instances, unreactive. In cases in which the degree of inflammation was rather severe, the enzymatic activity appeared after 10 minutes of incubation. Conversely, in tissues with a mild inflammatory reaction the intensity of the enzymatic reactivity was moderate. Interestingly, the enzyme was always present where some interstitial edema or acanthotic phenomena occurred. In fact, sections with structurally normal stratified squamous epithelium did not store any amount of phosphorylase. The iodine-treated sections of the control substantiate these observations in that no native glycogen could be detected. The underlying connective tissue, the inflammatory cells and the blood vessels (arterioles) were all negative. From a cytologic point of view, only the cytoplasm was reactive with the nuclei remaining unstained.

Altogether different was the localization of phosphorylase in the tongue of rats (Figure 5). While the epithelium and the connective tissue appeared to be completely devoid of enzyme, the muscular fibers were

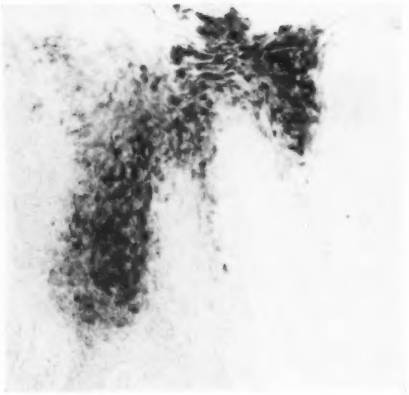

Fig. 2. Selective deposition of the enzyme in the prickle cell layer and the parakeratotic horny layer. Note the absence of phosphorylase in the adjacent rete pegs, in the stratum basale and the keratotic layer.

strikingly reactive thus demonstrating the highest concentration of phosphorylase.

DISCUSSION

The distribution of phosphorylase can be considered as indirect evidence of histochemically demonstrable carbohydrates in tissues which normally synthesize polysaccharides of the amylose or glycogen type. In the gingival mucosa, the enzyme distribution appears selectively involving certain cells of the stratum spinosum and granulosum. Sometimes the parakeratotic layer shows positive reactivity. However, the localization of the enzyme is not uniform. Some rete pegs are highly reactive while others are entirely devoid of phosphorylase.

The findings do not demonstrate the presence of the enzyme in the endothelium of capillaries as claimed by Braun-Falco[1] in his studies on the skin. Also, no evidence is derived in this study of positive reactivity in the epithelium of the tongue of rats as reported by Takeuchi, Higashi, and Eatanuki[10] in their original paper. To substantiate the latter findings, further experiments demonstrated that tongue sections stained by the PAS method failed to show the presence of glycogen in the epithelium. However, it might be possible, as asserted by Carbonell,[2] that the histochemical technique utilized may not be sensitive enough to demonstrate all the glycogen present in the tissue.

During the past few years various investigators have histochemically studied the problem of glycogen deposition in normal and pathologic gingivae. The different opinions expressed by several authors have been recently summarized by Carranza and Cabrini.[3]

One of the constant findings is the reverse relationship between the rate of keratinization and glycogen distribution in the cells. Hyperkeratinized areas are most often deprived of glycogen. In the skin, Montagna, Chase, and Lobitz, W. C.[8] believe that, under physiologic conditions, glycogen is found where the process of keratinization is impaired and that no glycogen occurs in cells undergoing rapid keratinization and high mitotic activity. In human gingivae, Weiss, Weinmann, and Meyer[11] have also demonstrated that glycogen appears most frequently in inflamed, unkeratinized epithelia while hyperkeratinized gingivae contain little or no polysaccharide. It has been often reported that glycogen is formed in squamous epithelium affected by spongiosis or inflammatory edema. As regards the gingival mucosa, Dewar[5] linked the presence of glycogen with the rate of inflammation.

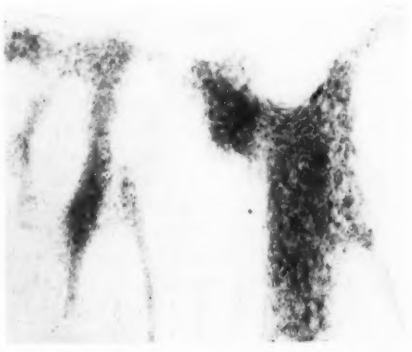

Fig. 3. Another aspect of the enzyme deposition. Note the large unreactive zone at the top of the picture where hyperkeratosis is present.

Fig. 4. Crevicular epithelium. Distribution of phosphorylase in the cells of the stratum spinosum.

Although it seems established that the breakdown of glycogen provides energy for cell activity, its functional role upon stratified squamous epithelia remains a question still open to debate and by no means defined.

The Takeuchi-Kuriaki technique for the demonstration of tissue phosphorylase is substantive and reproducible. Since physiologically occurring glycogen in living tissues is a branching polysaccharide and it is stained red-brown by the iodine method, it appears that the newly-formed polysaccharide in the gingiva is one of a relatively low molecular size because of its blue-black color. Since no special inhibitor ($HgCl_2$) was used for the 1,4→1,6 transglycosidase, the branching enzyme responsible for the complete synthesis of glycogen, it is believed that the dark color in both the gingival specimens and rat tongue represents a polysaccharide of the amylose type (amylopectin or slightly branched glycogen).

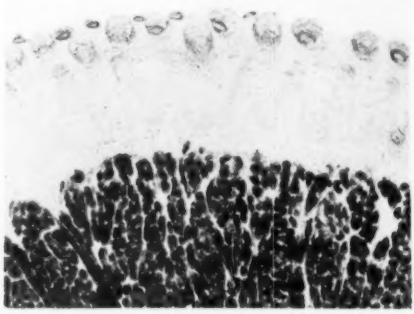

Fig. 5. Rat tongue. Intense enzyme reaction in the muscle bundles while the epithelium and the underlying connective tissue are devoid of phosphorylase.

SUMMARY

Phosphorylase, an enzyme essential for the synthesis of glycogen from glucose-1-phosphate, has been demonstrated in human gingivae. The enzyme was revealed utilizing the iodine method of Takeuchi and Kuriaki. Phosphorylase appeared localized at sites known to contain glycogen normally. The cell cytoplasm reacted positively while nuclei were always devoid of enzyme activity. The gingival mucosa showed some variability. However, phosphorylase was generally localized in the stratum spinosum and often in the parakeratotic horny layer. The stratum basale was always negative. Furthermore, the underlying connective tissue structures never gave rise to a positive reactivity.

The tongue mucosa of rats, utilized as controls, demonstrated a striking reactivity in the muscular fibers while the epithelial layers, in contrast to the findings in human gingivae, were entirely devoid of phosphorylase.

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Case Report . . . .

Successful Treatment of a Deep Two Wall Intrabony Pocket

by HAROLD R. SCHREIBER, A.B., D.D.S., *St. Louis, Mo.*

INTRABONY pockets have been classified on the basis of osseous wall present, either one, two, three or four. New attachment operations apparently are most successful in three wall intrabony pockets, while osteoectomy-osteoplasty procedures are commonly indicated to eliminate one and two wall intrabony pockets. The following is a case report of a two wall intrabony pocket treated with the new attachment operation.

The patient, a white male, 36 years of age, had been under treatment by his dentist for several years for moderately advanced periodontitis. For the last six months there had been a recurrence of a swelling on the lingual of the upper right cuspid and bicuspid area. Examination of the area revealed an essentially normal looking gingiva in the upper right cuspid-bicuspid area (Figs. 1 and 2). There was no pocket formation on the labial and lingual of the cuspid and bicuspid area. One could, however, insert a periodontal probe its full length in the interproximal area along the distal surface of the cuspid.

Radiographs of the area revealed a small

Fig. 1

Fig. 2

Washington University School of Dentistry, St. Louis, Mo.

Fig. 3

Fig. 4

Fig. 5

Fig. 6

amount of bone resorption on the labial and lingual surfaces (Fig. 3). Interproximally a deeply extending radiolucent area was present from the cervical bone level almost to the apex of cuspid and bicuspid. Both cuspid and bicuspid responded to vitality tests. A silver point was inserted into the bony defect and a new radiograph was made depicting its depth (Fig. 4). From the radiographs and additional probing on the labial and lingual, it was felt that the defect was surrounded by a labial and a lingual plate. How much labial and lingual plate was remaining could not be ascertained. Since the resorptive process appeared to involve the distal surface of the cuspid and mesial surface of the bicuspid, and since the prognosis appeared to be poor to retain either tooth individually, it was decided to explore the bony defect and arrive at a basis for therapy after the pathology and topography of the area was determined.

A gingivectomy was performed on the lingual and labial interproximal area. The depth of incision of the interproximal area was approximately five millimeters. The incised gingiva was separated from its periosteal attachment. Intact labial and lingual plates, though very thin, were present and to about the same level cervically (Figs. 5 and 6). If the labial or lingual plate were absent to a severe degree extraction might have been indicated. Between the labial and lingual plates a tenacious granulomatous tissue was present. With heavy curettes this granulomatous tissue was removed. After removal of the granulomatous mass, one could see the topography of the bony re-

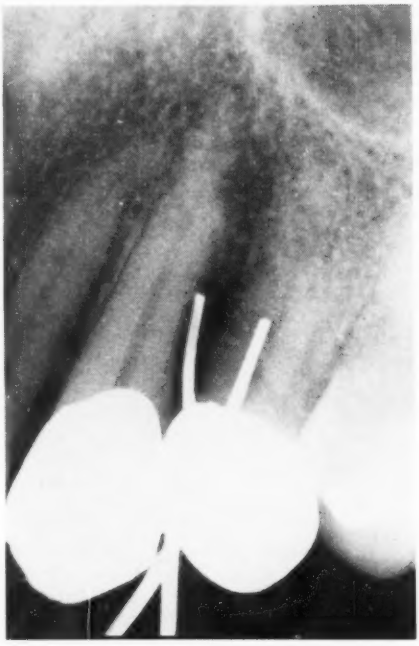

Fig. 7

sorptive lesion. This was a pyramidal shaped defect with the apex of the pyramid lying toward the cervical margin. The walls of the pyramid were composed of labial alveolar plate, lingual alveolar plate, the distal denuded cemental surface of the cuspid, and the mesial denuded cemental surface of the bicuspid tooth. The base of the pyramid or widest part of the lesion lay between the curvatures of the apical portions of roots of the cuspid and bicuspid teeth.

Since four walls were present it was decided to attempt the new attachment procedure. In order to gain more access for root curettage, a millimeter of the labial alveolar plate was removed. The remaining granulomatous tissue was removed with difficulty, as the resorptive area involved the labial, lingual, and apical curvatures of the roots. With fine curettes, the extensively denuded root surfaces of the cuspid and bicuspid were then curetted and planed. The defect was allowed to fill with blood, and the blood clot was protected inter-

proximally with a strip of tin foil. A surgical pack was placed to protect the entire area. Erythromycin, 250 mg., q6h, was prescribed for four days. The surgical packs were replaced weekly for five weeks. At the time of final pack removal, the interproximal area could not be probed.

Radiographs taken periodically indicated apposition of bone interproximally. The postoperative radiograph shown was taken 9 months after therapy (Fig. 7). An intact lamina dura is now present on the distal of the cuspid and mesial of the bicuspid to the cervical level of the labial and lingual plates of bone.

SUMMARY

A case report of a successfully treated two wall intrabony pocket has been reported. While emphasis on intrabony pockets continues to be placed on the number of osseous walls present, the one wall that is always present, that of the root surface, appears to be minimized. The response of the root surface, which is essentially a bone-like tissue, is imperative. This case illustrates an intrabony pocket with two walls formed by the root surfaces. While postoperative radiographs in successful cases indicate new bone formation and new lamina dura, it is assumed that a layer of cementoid has been laid down on the planed root surface. It is further assumed that new periodontal fibers are embedded in the newly formed cementoid and bone. In the case presented a mesio-distal postoperative section would probably show cementoid (distal surface of cuspid), periodontal ligament, osteoid, alveolar bone, osteoid, periodontal ligament and cementoid (medial surface of bicuspid).

UNIVERSITY OF ILLINOIS

A one day course in *Diseases of the Oral Mucosa* will be offered on Wednesday, November 22, 1961, by the University of Illinois College of Dentistry, Division of Postgraduate Education.

Visiting professor will be Jens J. Pindborg, D.D.S., Dr. Odont., of the Royal Dental College, Copenhagen, Denmark. Special emphasis will be given to disturbances in keratinization and bullous lesions.

The course will consist of lectures, with informal discussion and question periods. Wednesday, November 22, 1961, from 9:00 a.m. to 5:00 p.m. Tuition $25.00. For applications write Division of Postgraduate Education, University of Illinois College of Dentistry, 808 S. Wood St., Chicago 12.

Evaluation of the Vertical Method of Toothbrushing

by RICHARD A. SHICK, D.D.S., M.S., *Flint, Michigan* AND
MAJOR M. ASH, JR.,* D.D.S., M.S., *Ann Arbor, Michigan*

THE relative effectiveness of the vertical method of toothbrushing in preventing or removing the soft accretions on the surfaces of the teeth has never been conclusively studied. The objective of this study was to evaluate the effectiveness of the vertical method of brushing, using a toothbrush with an adjustable head, with the well known roll-method of brushing, using a "standard design" toothbrush.

REVIEW OF THE LITERATURE

Different methods have been used to evaluate oral hygiene and the effectiveness of brushing teeth. A frequently used procedure is the application of solutions to disclose the presence of debris or dental plaque on the teeth. Chawla, Nanda and Mathur,[4] Curtis, McCall and Overaa,[5] and Ramfjord,[20] used bismark brown in their disclosing solutions. Ramfjord,[20] in an epidemiological survey, observed the amount of stained dental plaques on the teeth and scored the individual teeth as 0, 1, 2 or 3. Greene[8] used a similar scoring index to record the amount of debris present on the surfaces of teeth without the use of a disclosing solution. The indexes of Ramfjord[20] and Greene[8] may be used for epidemiological studies but they are not sensitive enough to record the small differences in the presence of dental plaque which might be expected when measuring the effectiveness of toothbrushing.

The roll-method (sweeping motion) is "rather universally used"[2] and often is advocated.[2,5,6,9,13] The advocates of the roll-method agree that the "standard design" of toothbrush is used effectively and efficiently with this method of brushing. Thus, the roll-method using the "standard design" toothbrush was selected to be used as a basis of comparison with the vertical method of brushing (scrubbing motion) using a toothbrush with an adjustable head. A personal preference has been expressed by many writers for natural bristles;[1,3,6,9,13] however, there is no scientific or clinical evidence to indicate that either natural or nylon bristles are superior in removing plaques from the teeth. The only significant evidence presented for a particular type of bristle are the results of the laboratory studies[11,12,19,22] which indicated that nylon bristles were more uniform in diameter and stiffness than natural bristles. Thus, nylon bristles were used in this study that is being reported.

While commenting on the selection of groups with a limited number of subjects, Hill[10] stated, "with small numbers it will be wise to ensure equality, or near equality, by design." By design, Curtis, McCall and Overaa[5] grouped all the subjects in their study on the basis of stained teeth and the presence of gingivitis in order to have each group represent as equal as possible a typical sample of the entire body of subjects. Several other investigators[7,16,18,21] have attempted to equate their groups in all respects relevant to their studies. Thus, the method of choice for selecting the subjects or forming groups for studying toothbrushing should be "by design" rather than by random sampling.

The effectiveness of various methods of toothbrushing and the use of various toothbrushes were reported in six studies.[5,14,15,17,18,21] In these studies, a particular method of brushing or a particular toothbrush has been recommended. However, since none of the methods of scoring were analyzed for reproducibility, and none of the studies utilized precise criteria for scoring every tooth in the mouth, one may conclude that there is no substantiation for

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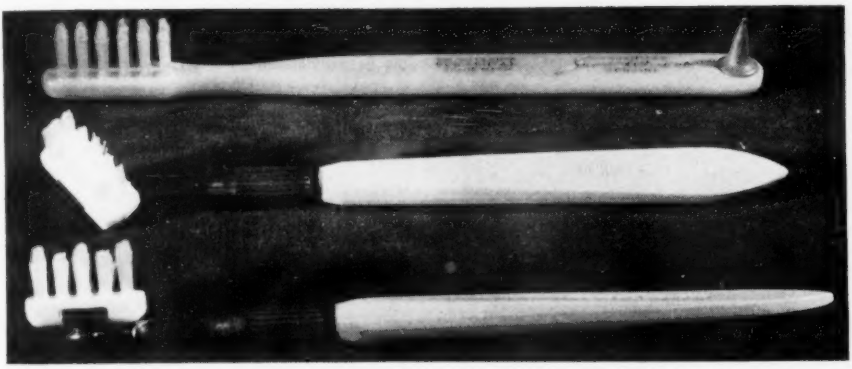


Fig. 1. Standard Design Toothbrush and Two Toothbrushes With an Adjustable Head.

recommending a particular toothbrush or method of brushing. Also, none of these studies were concerned with the vertical method of brushing.

MATERIALS AND METHODS

Two different types of toothbrushes were utilized for this study,* a "standard design" (SD) and an adjustable head (AH) (Figure 1). In order to determine the relative effectiveness of the vertical method of brushing with an AH toothbrush, the roll-method of brushing with an SD toothbrush was used as a basis for comparison. The SD toothbrush was selected because it has been recommended frequently for use with the roll-method of brushing. The AH toothbrush was selected because it was one of the few brushes specifically designed to be used with the vertical method of brushing.

The SD toothbrush had a solid straight handle and the bristles were arranged in two rows of six tufts. The SD toothbrush was accepted as effective for cleaning all surfaces of the teeth. The AH toothbrush had the head mounted on a wire loop so that one could rotate it 360°. The handle of the toothbrush could be turned to adjust the frictional tension on the head of the brush in order to hold it in any desired position. It also could be loosened so that the head could be replaced. The adjustable head facilitated the brushing of the facial (buccal and labial) and lingual surfaces of the teeth by short up-and-down strokes called the vertical method of brushing. The AH toothbrush had the bristles arranged in three rows of five tufts. When viewing this brush from the side, the tufts were found to be alternately long and short (Figure 1). This design was utilized to make it possible for the longer bristles to enter and clean the interproximal areas. All toothbrushes utilized in this study had "hard" nylon bristles.

Male Junior dental students were selected for this study. The subjects were similar in age, motivation, educational status, concepts of oral hygiene and gingival health. No students were used who had periodontitis, acute or recurrent necrotizing gingivitis, hyperplastic gingivitis or loss of interproximal tissue. This selection of subjects was utilized to minimize the variable factors not directly controlled by the study.

Methods of Toothbrushing. When using the roll-method of brushing, the sides of the bristles are placed horizontal with the long axis of the teeth and pressed against the attached gingiva with sufficient force to blanch the tissues momentarily. By rolling the wrist, the tips of the bristles are

*The "standard design" brush was supplied by the Dr. Butler Company and the toothbrush with an adjustable head was provided by the Clean-Be-Tween Corporation. All bristles were hard nylon.

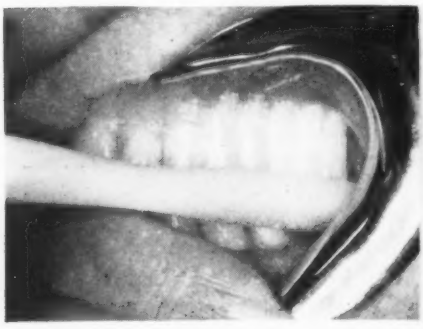
Fig. 2A. Bristles are horizontal with the long axis of the teeth.

moved slowly and firmly off the gingiva and lengthwise over the surfaces of the teeth. Briefly stated, this method brushes down on the upper teeth and up on the lower teeth (Figure 2).

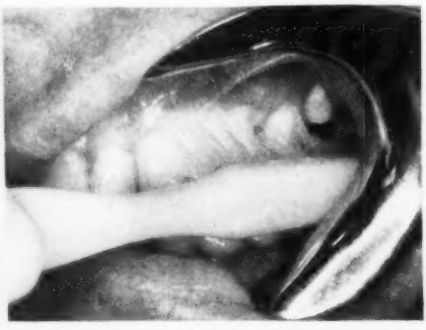
When using the vertical method of brushing, the head of the AH toothbrush is rotated to an angle of approximately 45° with the handle (Figure 1). With this adjustment of the head of the toothbrush, the facial surfaces of the teeth on one side of the mouth are brushed, also the mandibular lingual surfaces of the same side and the maxillary lingual surfaces on the opposite side of the mouth. The anterior teeth are positioned end-to-end and the bristles are placed at right angles to the facial surfaces of the teeth. The bristles then are moved up and down, brushing both maxillary and mandibular teeth with the ends of the bristles while massaging the gums with the sides of the bristles. When brushing the lingual surfaces of the teeth, the mouth is opened wide. In order to brush the rest of the teeth, the head of the brush is rotated so that it forms a 45° angle with the handle in a reverse manner to the previous setting and the remaining facial and lingual surfaces are brushed as previously described (Figure 4). If necessary, the head of the toothbrush may be turned at a right angle to the handle to facilitate the brushing of the facial and lingual surfaces of the anterior teeth.

It was emphasized during toothbrushing instructions that the sides of the bristles, not the ends, were to be used to massage the gums.

Scoring Plaques. Preliminary observations showed that none of the scoring indexes described in the literature were sufficiently sensitive to measure the small differences which might occur in a study of this nature. By modifying the epidemiological scoring indexes of Ramfjord[20] and Greene,[8] an index was developed to score small changes in the amount of plaque present on the gingival halves of the coronal surfaces of the teeth. Methods of scoring dental plaques cannot be considered reliable unless the results of scoring the same plaques can be reproduced within the limits of variability of the scoring index. In order to evaluate the reproducibility of

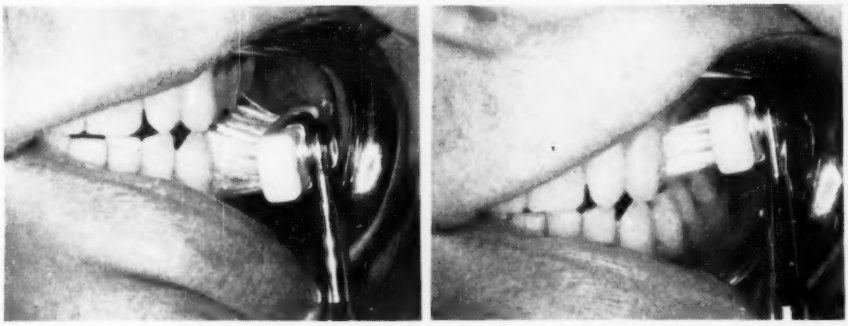


The tissues are blanched momentarily.



Bristles move lengthwise over the surfaces of the teeth.

Figure 2B



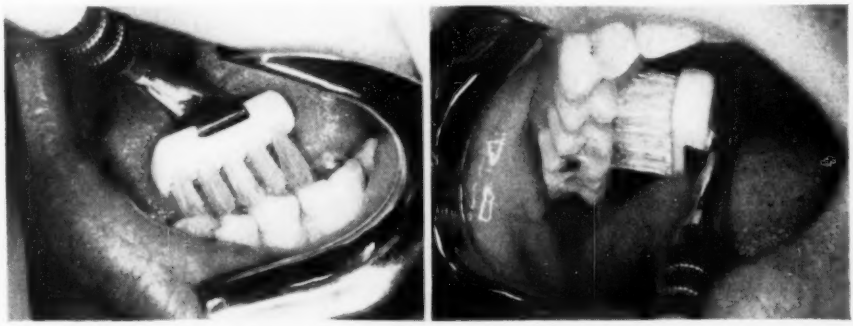
(left) Brush down. (right) Brush up.

Figure 3

the scoring index used in this study, four subjects were scored three times in the same morning. Cotton applicators were soaked in disclosing solution and the solution first was applied to the mandibular and then the maxillary teeth, covering one quadrant at a time. Each student was instructed to rinse his mouth thoroughly two times with water. Each tooth received a facial and a lingual score. The first scores for the individual teeth of each subject were compared with the second scores, and the second scores were compared with the third scores. These results indicated that the degree of variation of the three scorings was insignificant, and thus the scoring index was reproducible and reliable.

The amount of the surface covered by dental plaque was scored as *0*, *1*, *2* or *3*. "Dental plaque" was accepted as any soft accretion on the surface of a tooth that would retain disclosing solution. The absence of dental plaque on the gingival half of the facial surface of a tooth was scored as *0;* the presence of dental plaque covering less than one-third of the gingival half of the facial surface was scored as *1;* the presence of dental plaque covering one-third or less than two-thirds of the gingival half of the facial surface was scored as *2;* and the presence of dental plaque covering two-thirds or more of the facial surface was scored as *3* (Figure 5). The same scoring procedure was used for the lingual surfaces of the teeth. Thus, each tooth received a facial and a lingual score.

In order to convert the scores of dental plaques into a percentage-score (PS), the individual scores (S) of each tooth were added to get the total score (TS) of the



Brush lingual surfaces of mandibular teeth. Brush lingual surfaces of maxillary teeth.

Figure 4

Summary of Procedures

1. A scoring index was developed and standardized to measure the amount of dental plaque on the coronal surfaces of the teeth.

2. Clinical procedure — 80 subjects scored for dental plaque and then provided with a prophylaxis. → (1 wk.) Rescored for dental plaque. → (3 wks.) Rescored for dental plaque. Four equal groups were formed.
   - (A) 20 subjects
   - (B) 20 subjects
   - (C) 20 subjects
   - (D) 20 subjects

3. (A) Teeth Polished → (1 wk.) TBI-Vert. AH-Brush → (3 wks.) Scored TBI-Vert. AH-Brush → (4 wks.) Final Scoring

   (B) Teeth Polished → (1 wk.) TBI-Roll SD-Brush → (3 wks.) Scored TBI-Roll AH-Brush → (4 wks.) Final Scoring

   (C) Teeth Polished → (1 wk.) TBI-Roll SD-Brush → (3 wks.) Scored TBI-Roll SD-Brush → (4 wks.) Final Scoring

   (D) Teeth Polished → (1 wk.) TBI-Vert. AH-Brush → (3 wks.) Scored TBI-Vert. SD-Brush → (4 wks.) Final Scoring

   TBI — Instructions in toothbrushing
   Vert. — Vertical method of brushing
   Roll — Roll-method of brushing
   AH-Brush — Toothbrush with an adjustable head
   SD-Brush — "Standard design" of toothbrush

4. Data were statistically analyzed.

dental plaques for each subject. The total score was divided by the highest possible theoretical score (HTS) and this quotient was multiplied by 100 to arrive at a percentage-score for each individual.

$$PS = \frac{TS \times 100}{HTS}$$

The percentage-scores thus were comparable for all individuals regardless of the number of teeth present in the mouth of a subject.

The manner of grouping and alteration of the variables made it possible to compare the two different methods of brushing or the two different types of toothbrushes in relation to their effectiveness for preventing or removing the dental plaque from the coronal surfaces of the teeth.

Clinical Procedures. After the formation of the groups, all of the subjects' teeth were polished with a rubber cup and pumice to remove the dental plaques and reduce all of the scores to *0*. Each subject received two new toothbrushes and a three minute intra-oral demonstration of toothbrushing. The method of stating instructions in toothbrushing was practiced and standardized prior to the demonstrations. All of the subjects in each group were given comparable instructions for approximately the same length of time. They were instructed to use only the method of brushing and toothbrushes that were provided. Four weeks from the date the teeth were polished, the dental plaques again were scored. At this time, Group B was changed to the AH toothbrush and Group D changed to the SD toothbrush while Groups A and C continued with the same type of brush and all groups were given two new toothbrushes. All groups were given reinstructions in the same method of brushing previously employed. The change in toothbrushes for two of the groups provided a means of comparing the two types of toothbrushes using either method of brushing and the two methods of brushing using either type of toothbrush. Four weeks

METHOD OF SCORING THE PRESENCE OR ABSCENCE OF DENTAL PLAQUE

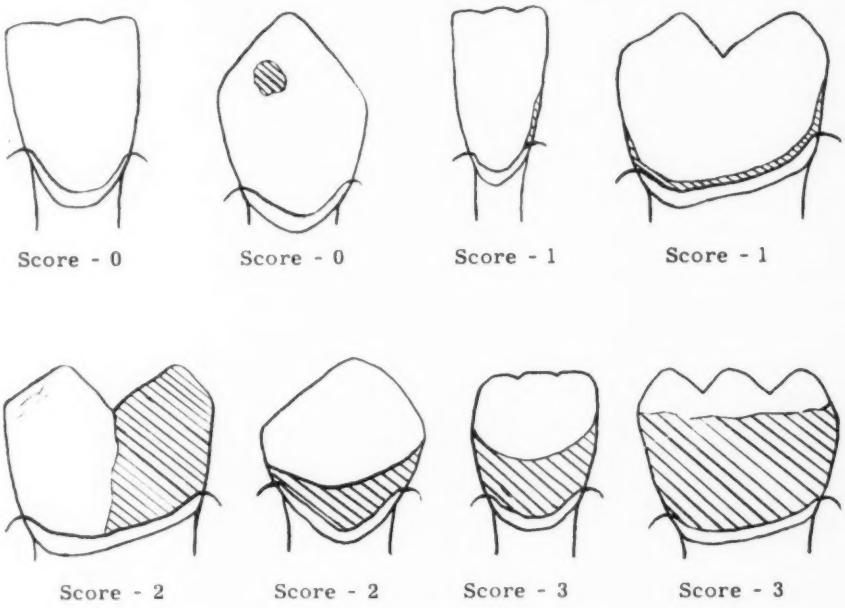


Figure 5

from the previous scoring, the subjects were scored for dental plaques for the final time.

Statistical Analysis of Data. The "t" test was used to analyze the *between-group* and *within-group* differences. Formula 1 was used to analyze the differences between the groups and Formula 2 was used to analyze the differences within the groups.

$$(1)\quad t = \frac{\overline{M}_1 - \overline{M}_2}{S\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}} \qquad S^2 = \frac{SX_1^2 + SX_2^2}{N_1 + N_2 - 2}$$

$$(2)\quad t = \frac{\overline{D}}{\frac{S}{\sqrt{N}}} \qquad S^2 = \frac{N \times SD^2 - (SD)^2}{N \times (N-1)}$$

RESULTS

The base-line mean dental plaque scores were calculated (from the first three scorings) for each of the four groups and also the mean dental plaque scores for the fourth and fifth scorings of each group (Table 1).

TABLE I

Base Line, Fourth and Fifth Scoring-Means for Each Group

Groups	*Base-Line Means (Avg. of first three scorings)*	*Means for 4th Scoring*	*Means for 5th Scoring*
A	42.25	35.80	35.35
B	42.60	35.65	37.25
C	42.20	34.85	34.45
D	42.25	35.00	35.95

Results of the calculations using the "t" test to analyze the differenecs *between* the groups and *within* the groups from the fourth to fifth scorings indicated there was no statistically significant differences at the five per cent level of confidence. However, when comparing the baseline means with

the means of the fourth and fifth scorings, there was a statistically significant difference at the one per cent level of confidence.

Since Ramfjord,[20] when doing an epidemiological study, selected six teeth to represent all the teeth of a subject, it was decided to compare the plaque scores using these six teeth with the plaque scores when using all the teeth. The results indicated there was no statistically significant difference in the scores of the dental plaque for the first three scorings when using six teeth or all the teeth of a subject.

DISCUSSION

The analysis of the differences *between* the four groups, using the means of the 4th and 5th scorings or analyzing the differences *within* the groups for these same means, produced no statistically significant differences at the five per cent level of confidence when using the "t" test. These results indicate that the vertical method of brushing with a toothbrush that had an adjustable head, was an effective way to prevent or remove dental plaque when compared with the roll-method using a "standard design" toothbrush. The results of this study also indicate that there was no difference in the prevention or removal of dental plaque when (1) using the roll-method of brushing with either the SD or AH brush, (2) using the vertical method of brushing with either the SD or AH brush, (3) using the SD brush with either the vertical or roll-method of brushing and (4) using the AH brush with either the vertical or roll-method of brushing.

The analysis of the differences within the groups, when comparing the four baseline means with the means of the fourth and fifth scorings, demonstrated a statistically significant difference at the one per cent level of confidence in every comparison. These results indicate that after new toothbrushes and instructions were given, all of the groups, regardless of the method of brushing or toothbrush utilized, showed a statistically significant improvement in the effectiveness of preventing or removing dental plaque on the gingival half of the coronal surfaces of the teeth. Thus, the new toothbrushes and instructions appear to be more effective, in obtaining favorable results, than the type of toothbrush or method of brushing.

The preliminary testing of the index for scoring dental plaque indicated that this method of measuring the presence or absence of dental plaque on the gingival half of the coronal surfaces of the teeth was both reliable and reproducible when measuring the same plaques. The weakest aspect of this scoring index was the differentiation between a score of 0 or 1. It is possible that the addition of another division between 0 and 1 would make the index more sensitive in scoring the small changes in the presence of plaques. With such a modification, it should be possible for a study to determine if instructions in the various methods of toothbrushing with different toothbrushes would produce not only a statistically significant improvement but also a biologically significant improvement.

Ramfjord's[20] selection of six teeth to represent the entire mouth when scoring dental plaques appears to be an accurate representative selection. Thus, the use of these six teeth instead of all a subject's teeth, would facilitate using large numbers of subjects when doing a study related to the presence or absence of dental plaque.

SUMMARY

Eighty Junior dental students were divided into four groups which were as nearly alike as possible for the purpose of this study. Using these groups, an evaluation was made of the vertical method of brushing using a toothbrush with an adjustable head. The roll-method of brushing with a "standard design" toothbrush was selected as a basis for comparison. The degree to which stained dental plaques covered the gingival halves of the coronal surfaces of the teeth was used as an index for measuring the effectiveness of the toothbrushing. The "t" test was utilized

to compare the results before and after the introduction of toothbrushes and instructions and also to compare the two methods of brushing with the two different toothbrushes.

CONCLUSIONS

Within the limits of the design of this study, it was possible to make the following conclusions:

1. The vertical method of brushing with a toothbrush that had an adjustable head was equally as effective for removing or preventing the dental plaque as the roll-method using a "standard design" of toothbrush.

2. The "standard design" of toothbrush and the toothbrush with an adjustable head seem to be equally effective with either the roll or vertical method of brushing for removing or preventing dental plaque.

3. The scoring index utilized appears to be a reliable method for measuring the effectiveness of toothbrushing in respect to the presence of dental plaque.

4. The instructions with a new toothbrush appear to be of greater importance for removing or preventing dental plaque than the use of a particular type of toothbrush or method of brushing.

5. The mean plaque scores of six teeth were found to be representative of the mean plaque scores when using all of the teeth.

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A Brochure for Periodontal Patients

by GERALD M. KRAMER, D.M.D.,* *Boston, Mass.*

THE nature of periodontal disease requires special management. Unlike another disease which may be self-limiting (common cold), or responsive to surgery and then forgotten (appendicitis), periodontal disease is progressively destructive and seldom aborted by a single operative procedure. It can be likened to the diabetic state. This condition is one in which the patient is brought to an optimum level of health, within the limits of his particular problem, and then maintained at that level with a rigid discipline. As in diabetes, the regime required to restore and retain periodontal health varies with the severity of the disease, the constitution of the individual and the associated influencing factors.

The treatment of periodontal disease can be divided into active and inactive phases. The active phase concerns itself with the correction of the periodontal lesions. This is accomplished by a variety of treatment methods such as scaling, curettage, periodontal surgery, occlusal adjustment, etc. The periodontist's energy is expended in restoring the periodontium to a state of health in which the resistance systems of the body can cope with new irritational and functional attacks.

At the conclusion of active periodontal therapy, the patient is placed on inactive therapy. This involves sundry home care routines and periodic office treatments. This control phase is essential to the ultimate objective of periodontal treatment which is a healthy periodontium.

Patient acceptance of several months of periodontal treatment in addition to an indefinite period of control is basic to periodontal practice. Cooperation between the doctor and patient depends upon close rapport and the patient's intelligent approach to his disease problem. The brochure that follows was written to ease the burden of the periodontist in preparing the patient for his treatment. It also introduces the patient to a scientific discipline which he has not previously experienced.

The brochure follows:

A BROCHURE FOR PERIODONTAL PATIENTS

Among the elements that lead to success in treating any disease problem are two that stand out. They are (1) an understanding of the problem by both the patient and the dentist or physician and (2) a treatment plan or program that is mutually agreed upon beforehand.

It is for these reasons that this brochure has been prepared. It is intended primarily for those patients who are anticipating treatment for periodontal disease so that they may acquaint themselves with some of the basic problems that confront them in their mouths.

The pamphlet is arranged as a series of answers to the questions most frequently asked by prospective periodontal patients.

1. What is periodontal disease?

   Periodontal disease affects the supporting structures of the teeth. These supporting tissues are chiefly the gums and the bone that holds the teeth to the jaws.

2. Is there just one type of peridontal disease?

   No. There are many types of periodontal disease and also variations of these. The lay public is acquainted with periodontal disease by the terms "pyorrhea" and "gingivitis." These terms are not significant to the dentist, however, because they do not describe the type or severity of the gum disease.

3. Whom does periodontal disease affect?

   Periodontal disease is a universal disease. There is no country or people that is free from it. Many statisticians state that it is the most prevalent of all diseases of mankind. It affects both males and females, child and adult. It appears most frequently in middle life although some of the most severe forms of the disease are found in the younger age group.

4. Why treat periodontal disease?

   The chief reason for treating periodontal dis-

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ease is to preserve the natural teeth in the mouth. Without treatment there is a continuation of the destruction of the supporting tissues of the teeth to a point where the teeth loosen and fall out. Also, from the point of view of general health, it is understood that gum disease may act as a focus from which disease may spread to other parts of the body. Treatment will prevent this. For other reasons such as bleeding, bad breath, and poor esthetics, periodontal treatment should be performed.

5. Can periodontal disease be cured?

Yes. There are a few exceptions, of course. If the destruction of the tissues around the teeth has reached the point where there is practically no support remaining, there is little that can be done. However, as in any other disease, if treatment is instituted at the proper time, a successful result can be expected.

6. What is the relationship between periodontal disease and other dental problems?

The chewing mechanism, that is, the jaws, the supporting tissues, and the teeth must be considered as a single organ just as the heart, kidneys, etc., are organs even though there are different parts that make up the whole unit. Any disease that effects one part of the chewing organ, such as dental decay, gum disease, bone diseases of the jaws, etc., can, and usually does, influence the state of health of other parts. Again, therefore, if a tooth is lost and not replaced, if there are replacements in the mouth that have outlived their usefulness, or if there are numerous other dental problems, all must be corrected in order to preserve the health of not only the immediate area affected but also the health and integrity of the whole mouth.

7. How long will treatment take?

That will depend, of course, upon the nature and severity of the disease presented at the beginning of treatment. Length of treatment varies from a short period of a few days to a longer period of several months.

8. What will be the fee for treatment?

Again, the fee will be determined by the nature and severity of the disease. One of the factors influencing the cost of treatment will be the presence or absence of associated dental problems (missing teeth, abscessed teeth, dental surgery, etc.). Treatment problems vary greatly in almost every case.

9. Will the treatment have to be repeated every few years?

No. In most instances, depending upon the seriousness of the condition, a single course of therapy with periodic checkups will be sufficient to restore and maintain the health of the tissues. Periodic cleaning of the teeth in the dental office and regular visits to check results of treatment are necessary. However, this is little more than is required of patients who have had no periodontal disease and who are careful to watch the health of their mouths.

10. Can loose teeth be tightened?

In most instances, yes. After periodontal treatment, many previously loose teeth will be found to have tightened. For those teeth that have lost too much support to become firm after routine therapy, there are other methods available to stabilize loose teeth.

11. Is periodontal disease inherited? Is it contagious?

Most authorities feel that it is possible to inherit a predisposition to periodontal disease. That is to say, some people may inherit a tendency to have breakdown in their gum structures. That does not mean, however, that if some members of a family have lost their teeth due to "pyorrhea" that other members will be affected also. Early diagnosis, proper treatment, and periodic checking on results of therapy are much more important than the influence of heredity.

Periodontal disease is not contagious.

SUMMARY

A brochure designed to educate patients regarding their periodontal problems has been presented. It has proven to be a useful adjunct in promoting patient compliance and understanding of a disease entity requiring above average cooperation for successful results.

9 Nahant Street, Lynn, Massachusetts

HAIDEE WEEKS, D.D.S.

We regret to announce that Dr. Haidee Weeks, prominent periodontist in New Orleans, Louisiana, died September 24, 1961. Further details will be published in the next issue.

ROBERT L. DEMENT, D.D.S.

November 24, 1888 - June 15, 1961

Dr. Robert L. Dement, widely-known periodontist from Atlanta, Georgia, died June 15, 1961, following a long and illustrious career in periodontology and dental education. He was graduated from Atlanta Dental College and was associated for many years with Dr. Thomas P. Hinman. Since 1928 he had limited his part-time practice to periodontics, and for 25 years held the chair of Periodontology at the Atlanta Southern Dental College.

Dr. Dement was active in organized dentistry, serving as President of the Fifth District Dental Society, the Georgia State Dental Association, the Southern Academy of Periodontology and the American Academy of Periodontology. He also found time to present papers and clinics before innumerable national and local organizations.

Dr. Dement had a wide acquaintance of friends because of his pleasant, congenial manner. He was a truly professional gentleman in every respect and his influence was always for the best in dentistry.

Book Reviews . . . .

A HANDBOOK OF DIFFERENTIAL ORAL DIAGNOSIS

The postgraduate Dental Lecture Series. Written by Major M. Ash, Jr., B.S., M.S., D.D.S., Associate Professor of Oral Pathology and Periodontia, the University of Michigan, School of Dentistry, Ann Arbor, Michigan, C. V. Mosby Co., St. Louis, 1961, 234 pages, 19 chapters, Price $6.50.

This text is unusual in that chapters are not designated by subject matter covered but rather alphabetically by letter. Under Chapter A for example, the subjects covered include abrasion, attrition, erosion, acid base balance, allergy, anemia and arthritis. Each subject is covered in a clear concise manner.

Perhaps the one noticeable drawback is that overlapping of subject matter has caused a system of cross references, which necessitate searching multiple areas in order to obtain complete material. This type of heading has further led to the confusing fact that material forming a differential diagnosis may be found widely scattered under a variety of subjects.

The author has called this fact to the reader's attention in the preface when he says "As might be expected such an arrangement has resulted occasionally in some degree of unavoidable overlapping. Cross references have been included in the body of the text as well as in the index."

In a few areas the author has left to assumption that the reader has heard of, or will understand the meaning of certain terms, for example under the heading of "bleeding" he lists "Factor VII and Factor V" as "intravascular factors of hemostasis." In a later paragraph he describes Factor V but leaves the reader to his own devices for an explanation of Factor VII.

This text is intended as a supplement to standard texts on Oral diagnosis. In the opinion of the reviewer this has been accomplished. The author is to be complimented on his contribution and the student and practitioner are encouraged to avail themselves of this excellent reference and refresher source, to aid in diagnosis of more difficult cases.

N. M. H.

ACCEPTED DENTAL REMEDIES

Accepted Dental Remedies 1961 is the twenty-sixth edition of a book that has become widely recognized as a handbook of dental therapeutics. The book is used extensively in the dental schools but its principal function is to provide the practicing dentist with information on the usefulness of drugs in dentistry. It further serves to alert the dentist to special problems that may be encountered when a patient seeks dental service while receiving medication or treatment by a physician. Emphasis is placed upon the importance of cooperation between the dentist and physician when the patient gives a history of diabetes, cardiovascular disease or of medication with such potent drugs as the corticoids.

The revised edition contains expanded sections on dental therapeutics. The monographs have been reviewed by the Council and its consultants and have been rewritten in the light of current scientific information. The chapter on "Fluoride Compounds" has been revised and expanded to include a discussion of the physiology of fluorides, fluoridated

water, dietary fluoride supplements, topical application of fluorides, with particular reference to sodium fluoride solutions, stannous fluoride solutions and dentifrices which contain stannous fluoride. No changes have been made in the format which has proven so popular in the past several years.

As in earlier editions, Accepted Dental Remedies 1961 includes information concerning drugs of recognized value in dentistry, drugs of uncertain status more recently proposed for use by the dentist, and some drugs once employed extensively but now generally regarded as obsolete. Only brands of drugs which the Council has accepted as of demonstrated value in dentistry are listed.

Accepted Dental Remedies 1961 contains 244 pages, including the provisions for acceptance of products, a general index, a distributors' index, an index of current reports from the Council and the Division of Chemistry, and an index of more recent reports on products not listed in the book, including those classified in Groups B, C and D. The book sells for $3.00 a copy and is now available from the Order Department of the American Dental Association.

TUFTS UNIVERSITY SCHOOL OF DENTAL MEDICINE

The curriculum in Periodontology has been developed with a view toward the expanding interrelationships of modern periodontal practice with other phases of dentistry, medicine and biologic science. Sufficient flexibility of subject matter is permitted in the presentation of courses to afford the continuity and correlation of training so essential for a comprehensive educational background.

Periodontology I is a two-year (two academic years of 18 consecutive months) specialist training program for individuals interested in qualifying for certification in Periodontia. It has been arranged in conformity with the requirements of the American Board of Periodontology. Approximately one-half of the course is devoted to didactic instruction, and the remainder to clinical work. In addition to training in the Periodontia clinic, the student is given the opportunity of participating in clinics of allied dental and medical specialties. This wide range of clinical contact provides a useful background for expert management of periodontal problems.

Periodontology II, a one-year specialist training program, is a modification of the two-year course and is offered for individuals with a year's previous graduate or postgraduate training in Periodontology.

Periodontology III is intended for individuals interested in the academic and research aspects of Periodontology, as well as preparation for specialty board certification. The course ordinarily takes two years and leads to the degree of Master of Science or Master of Dental Science. The course consists of the following subdivisions:

I. Didactic instruction in pre-clinical sciences;

II. Clinical training in Periodontology;

III. Research and thesis. The facilities of the Ziskin Memorial Research Laboratory in the Department of Periodontology, as well as those of other departments of the medical and dental schools are available for research activities.

For further information write: Director, Division of Graduate Studies, Tufts University School of Dental Medicine, 136 Harrison Avenue, Boston 11, Massachusetts.

Announcements . . . .

PROGRAM AMERICAN ACADEMY OF PERIODONTOLOGY 1961 MEETING

The 1961 meeting of the American Academy of Periodontology will be held on board the M.S. *Bergensfjord* en route to Bermuda. Committees in charge of the meeting are:

LOCAL ARRANGEMENTS
Neal W. Chilton, *Chairman*
Craft A. Hopper
Robert H. Gilbert
Melvin L. Morris
Hyman J. V. Goldberg

PROGRAM
Perry A. Ratcliff, *Chairman*
Henry M. Swenson
Robert Gottsegen
Saul Schluger
Claude L. Nabers

CLINIC
D. Walter Cohen, *Co-Chairman*
Julius J. Bentman, *Co-Chairman*
Richard Chace
Paul N. Baer

RESEARCH FORUM
Helmut A. Zander, *Chairman*
Frank M. Wentz
Charles H. M. Williams

ENTERTAINMENT
Francis J. Fabrizio, *Chairman*
Floyd E. Lytle
Allan L. Wallace
Arthur Gold, *Chairman of Golf Tournament*

REGISTRATION
Frank D. Paul, *Chairman*
Glenn H. Curtis
Joseph Barkley
Wallace C. Mayo
C. Kenneth Collings
Henry B. Squires
Odin F. Leberman

ROUND-TABLE LUNCHEON
Justin D. Towner, *Co-Chairman*
Leonard S. Hirschfeld, *Co-Chairman*

PUBLICITY
Howard A. Hartman, *Chairman*
Willem A. C. Bester

PROPERTIES
Albert G. Paulsen, *Chairman*

RESEARCH FORUM
Friday, October 20, 1961

P.M.

2:30 "Miniature Radio Transmitters in the Study of Occlusal Contact Patterns." Hans Graf, D.M.D., Eastman Dental Dispensary, Rochester, New York.

2:55 Discussion

3:00 "Stress-Nutrition Inter-relationships in Periodontal Disease." Max Shapiro, D.D.S. and B. H. Ershoff, M.D., Ph.D., Institute for Biological Research, Culver City, California.

3:20 Discussion

3:25 "The Effect of Salivary Mucins on the Gamma Globulin Fraction of Saliva." George Raust, D.D.S., M.S., School of Dentistry, University of California, San Francisco, California.

3:45 Discussion

3:50 "Synthesis of Mucopolysaccharides by Human Epithelial Cells *in Vitro*." John C. Thonard, B.D.Sc., L.D.S., Ph.D., School of Dentistry, University of Pittsburgh, Pittsburgh, Pennsylvania.

4:10 Discussion

4:15 "Staining, Occurrence, and Proliferation of Plasma Cells in Gingiva." Donald L. Anderson, D.D.S., Faculty of Dentistry, University of Toronto, Toronto, Canada.

4:35 Discussion

4:40 "The Gingival Sulcus and Periodontal Pocket After Ultrasonic Scaling and Hand Planing." Gregg Stende, D.D.S. and Erwin M. Schaffer, D.D.S., M.S.D., School of Dentistry, University of Minnesota, Minneapolis, Minnesota.

5:00 Discussion

5:05 "Studies on Tooth Mobility." Hyman J. V. Goldberg, D.M.D., Eastman Dental Dispensary, Rochester, New York.

5:25 Discussion

CLINICS

P.M.

2:30 Management of Detrimental Occlusal Stresses in Periodontal Disease
Sidney Friedman, Jr., D.D.S.
Memphis, Tennessee

Occlusion
James C. Westbrook, Jr., D.D.S.
Birmingham, Alabama

Full-Mouth Periodontal Surgery as a Hospital Procedure
Frederick J. Halik, D.D.S.
Rochester, New York
Frank Fiaschetti, D.D.S.
Binghamton, New York

Effect of Improper Occlusion on the Periodontium
Albert Paulsen, D.D.S., M.S.D.
Falls Church, Virginia

Intravenous Premarin in Periodontal Surgery
Robert Wolfsohn, D.D.S.
Buffalo, New York

Periodontal Indication for Tooth Sectioning
Leonard Weiner, B.A., D.M.D.
Tucson, Arizona

Basic Surgical Procedure for Pocket Eradication
Sidney Sorrin, D.D.S.
New York, New York
Howard Ward, B.A., D.D.S.
New York, New York

Ultrasonic Instrumentation in Periodontal Therapy
Sol Ewen, B.S., D.D.S.
New York, New York

Periodontal Preparation for Telescope Crowns
Marvin Alderman, D.D.S.
Syracuse, New York

Failures of Periodontal Surgical Procedures
Neal Chilton, B.S., D.D.S., M.S.D.
Trenton, New Jersey

6-7:30 Friendship Hour

October 21

A.M.

9:00	First Session of Forty-Seventh Meeting— Invocation	B. O. A. Thomas, *President*
	Necrology Report	Stanley C. Baker
	Reports of Standing Committees Committee:	
	Constitution and Bylaws	Harry Lyons
	Membership	Hunter Allen
	Nomenclature and Classification	Henry Goldman
	Education	Frank Beube
	Research in Periodontology	Irving Glickman
	Scientific Sessions	Sigurd Ramfjord
	Ethics	Allison James
	Announcements Local Arrangements	Neal Chilton
10:00	*Presidential Address*	B. O. A. Thomas

SCIENTIFIC SESSIONS
PROGRAM COMMITTEE

Perry A. Ratcliff, *Chairman*

Henry M. Swenson	Saul Schluger
Robert Gottsegen	Claude L. Nabers

10:30-11:50 Histopathology and Biochemistry of the Periodontium.
Harold Stanley, B.S., M.S., D.D.S. (NIH)

11:50-12:00 Question period

P.M.

12:15- 1:45 *Round-table Luncheon*
Justin D. Towner, *Co-Chairman*
Leonard S. Hirschfeld, *Co-Chairman*

"Sell Anything"
H. Roger Turner, D.D.S.
Miami, Florida

Session Chairman

Claude Nabers, D.D.S.
San Antonio, Texas

2:30- 3:00 Report of Survey of Dentistry—Its Impact on Periodontology.
Robert Kesel, M.S., D.D.S.—Professor of Applied Materia Medica and Therapeutics—University of Illinois, College of Dentistry.

3:00- 3:15 Question period

3:15- 4:00 Factors which Determine the Pattern of Bone Destruction in Periodontal Disease.
Irving Glickman, B.S., D.M.D.—Research Professor of Oral Pathology; Professor and Chairman of the Department of Periodontology—Tufts University School of Dental Medicine.

4:00- 4:30 The Periodontal Hazard of Third Molar Extractions.
Major Ash, B.S., D.D.S., M.S.—Associate Professor of Dentistry, University of Michigan School of Dentistry.

4:30- 5:00 Evaluation of Current Surgical Procedures.
Jack Bloom, B.S., D.D.S.—Associate Professor Periodontology and Oral Pathology—Chairman of the Section of Oral Pathology Department of Stomatology, Boston University School of Medicine.

5:00- 5:30 Question period.

October 24

A.M.

Session Chairman

Henry Swenson, D.D.S.
Indianapolis, Indiana.

9:00- 9:45 Recent Findings in Collagen Research.
Bernard Gould, S.B., Ph.D. Associate Professor Biochemistry M.I.T.

9:45-10:30 Microbiology of Periodontal Disease.
John Macdonald, D.D.S., M.S., Ph.D. Director Forsyth Dental Infirmary —Professor of Microbiology, Harvard School of Dental Medicine.

10:30-10:50 Recent Research in Calculus.
Helmut Zander, M.S., D.D.S. Head, Dept. of Periodontology Eastman Dental Dispensary.

10:50-11:00 Question period.

P.M. *Symposium on Practice Management*

2:30- 3:00 Moral and Ethical Responsibility of the Periodontal Specialist.
Maynard K. Hine, D.D.S., M.S. Dean, Indiana University School of Dentistry.

3:00- 5:00 1) Education and Motivation of the Periodontal Patient.
Arthur Gold, D.M.D. Associate Professor of Periodontology
Tufts University School of Dental Medicine.

2) Management of Periodontal Surgery in the Dental Office.
Delbert Nachazel, D.D.S. Professor and Chairman Dept. of Periodontology—Marquette University School of Dentistry.

3) Periodontal Surgery in the Hospital.
Arnold Ariaudo, B.S., D.D.S. Associate Professor
University of Southern California Dental School.

4) The Recall System.
Don Ball, D.D.S. Staff of Christ Hospital, Cincinnati, Ohio.

5) Use of a Hygienist in Periodontal Practice.
John McKenzie, D.D.S. Miami, Florida.

6) Management of the Patient with Necrotizing Ulcerative Gingivitis.
Erwin Schaffer, D.D.S., M.S.D. Clinical Professor and Chairman
Division of Periodontics—University of Minnesota School of Dentistry.

7) Problems of the General Practitioner.
Robert Morrison, B.S., D.D.S. Las Vegas, Nevada.

5:00- 5:30 Panel discussion.

TEMPLE UNIVERSITY SCHOOL OF DENTISTRY

Temple University School of Dentistry announces the following postgraduate courses:

February 5, 6, 7, 8, 9, 1962—Periodontal Prosthesis.
Morton Amsterdam, D.D.S., F.A.C.D., and D. Walter Cohen, D.D.S.
Tuition $275.00. Enrollment limited.

March 7, 8, 1962—Electronic Electrosurgery.
Maurice J. Oringer, D.D.S.
Tuition $60.00. Enrollment limited.

April 9 to 13, 1962—Advanced Surgical Techniques in Periodontal Therapy.
Saul Schluger, D.D.S. and Jack Alloy, D.D.S.
Tuition $300.00. Enrollment limited.

For further information please write to Dr. Louis Herman, Director of Postgraduate Studies, Temple University School of Dentistry, 3223 North Broad Street, Philadelphia 40, Pennsylvania.

PHILADELPHIA SOCIETY OF PERIODONTOLOGY

The Philadelphia Society of Periodontology is presenting a one-day symposium on "Mucogingival and Osseous Surgery," to be held on Wednesday, January 17, 1962. The speakers will be Drs. Walter McFall, D. Walter Cohen, Herman Corn, Frank Wentz, Harry Bohannan.

For further information write Dr. Arthur B. Hattler, 607 Suburban Square Building, Ardmore, Pennsylvania.

CHICAGO DENTAL SOCIETY

The North Side Branch of the Chicago Dental Society has arranged a one-day workshop on "Advanced Surgical Concepts in Periodontal Therapy," to be presented on Wednesday, December 6, in the Villa Moderne Motor Hotel, Highland Park, Illinois. The program will be presented by Drs. Harry Sicher, Clifford Ochsenbein and Harry Staffelino.

For further information please write Dr. John A. Anderson, 2760 West Foster, Chicago, Illinois, or Dr. S. C. Burnell, Old Orchard Professional Building, Skokie, Illinois.

UNIVERSITY OF WASHINGTON

The University of Washington School of Dentistry (Department of Postgraduate Dental Education) is presenting a refresher course on "Current Surgical Procedures in Periodontics" on Tuesday and Wednesday, November 7 and 8, 1961. The course will be presented by Drs. Clifford Ochsenbein and Saul Schluger.

Additional information may be obtained by writing the Director of Postgraduate Dental Education, University of Washington School of Dentistry, Seattle, Washington.

UNIVERSITY OF PENNSYLVANIA RESEARCH AND TEACHING TRAINEESHIPS

Research and teaching traineeships in the basic sciences, in periodontology, and in the comprehensive treatment and rehabilitation of the cleft palate patient are available at the School of Dentistry, University of Pennsylvania. All traineeships are supported by the United States Pubic Health Service. Annual stipends vary from $5,000.00 and up, depending on the qualifications and needs of the successful candidates.

Inquiries concerning the basic science and cleft palate traineeships should be sent to the Chairman, Committee on Traineeships and Fellowships, University of Pennsylvania, School of Dentistry, 401 Spruce Street, Philadelphia 4, Pennsylvania. Inquiries for the traineeships in periodontology should be sent to: Dean, Graduate School of Medicine, 237 Medical Laboratories, University of Pennsylvania, Philadelphia 4, Pennsylvania.

MIDWEST SOCIETY OF PERIODONTOLOGY

The Midwest Society of Periodontology will hold a meeting in Chicago on February 18, 1962, beginning at 10:30 a.m. Speakers will be Drs. John R. Ring and Sigurd Ramfjord. There will also be a luncheon with Dr. Maynard K. Hine as speaker.

For additional information please write Dr. Henry M. Swenson, 1121 West Michigan Street, Indianapolis 2, Indiana.

FAIRLEIGH DICKINSON UNIVERSITY

Fairleigh Dickinson University School of Dentistry Postgraduate Division is presenting the following courses of interest to periodontists:

March 5, 6, 7, 1962—
Periodontic Concepts and Procedures.
By Abram I. Chasens and Staff

The course is designed for the general practitioner, and will cover the etiology, diagnosis and treatment of periodontal disease. Surgical technique for pocket eradication will be stressed. The subject will be presented through the media of lectures, slides and clinic demonstrations. Fee $150. Limit 15.

April 2, 3, 4, 5, 6, 1962—
Principles of Occlusion in Dentistry.
By Abram I. Chasens, James V. Giordano and Walter H. Mosmann

This course will include the aspects of occlusion, from the viewpoint of the periodontist, prosthodontist and orthodontist. Technic for equilibrating natural dentition by selective grinding. Readjustment of occlusion by tooth movement. Application of principles of occlusion in the construction of prosthodontic appliances. Fee $200. Class limited.

April 23, 24, 25, 1962—
Advanced Technics in Periodontal Therapy.
By Abram I. Chasens and Staff

This course is suggested for those who have had previous training in periodontics. Course will include advanced technics in surgery with discussion, demonstration and participation. Case analysis and overall treatment planning will be discussed. Fee $150. Class limited.

For further information write Postgraduate Division, School of Dentistry, Fairleigh Dickinson University, Teaneck, New Jersey.

ARMED FORCES INSTITUTE OF PATHOLOGY

The Armed Forces Institute of Pathology will present its annual postgraduate course "Pathology of the Oral Regions" March 12-16, 1962, in Washington, D. C.

The theme of this year's course will be the role of pathology in establishing the correct diagnosis and the course of treatment that follows. The faculty will consist of well qualified teachers from military and civilian institutions. Featured lecturers will be Dr. Donald A. Kerr of the University of Michigan, and Dr. Robert J. Gorlin from the University of Minnesota. There are no fees for this five day course.

Quotas have been established for both civilian and military personnel. Members of Federal Services who wish to attend under orders should apply through appropriate military channels. Civilians interested in enrolling in the course may apply to the Director, Armed Forces Institute of Pathology, Washington 25, D. C. Applications should be submitted at least two months in advance of the course.

UNIVERSITY OF KENTUCKY

The University of Kentucky College of Dentistry announces the following postgraduate courses for the fall of 1961.

Oral Diagnosis and Clinical Oral Pathology. September 30, 1961. Stephen F. Dachi and Associates.

Restorative Dentistry. November 2 and 3, 1961. John H. Mosteller.

Periodontics for the General Practitioner. December 4-6, 1961. Harry M. Bohannan.

Further information may be obtained from Director of Postgraduate Education, College of Dentistry, University of Kentucky, Lexington, Kentucky.

Letter to the Editor

I read with interest the article on treatment of hypersensitive teeth* by Milton R. Ross in the January 1961 number of the Journal. His results in reducing sensitivity by the use of strontium chloride are significant and indicate that this agent may well supplant formalin** in such cases.

I was particularly interested in Ross's comments on the etiology of this condition. In addition to erosion, abrasion caries, etc., which he mentioned, I have noticed a factor not often reported, namely, traumatic occlusion. As is well known, teeth subjected to the stress of traumatic occlusion usually suffer resorption of alveolar bone (along with periodontal inflammation) and become more or less mobile. Such teeth do not ordinarily become sensitive to cold. However, I have found that not all teeth subjected to traumatic occlusion suffer loss of alveolar bone and thus do not become mobile, this apparently being due to superior stress resistance in the bone. Teeth in this case often develop hypersensitivity to cold, but without surface sensitiveness. Evidence of the cause and effect relationship in these cases is found when the teeth so affected lose their excess sensitivity when the traumatic occlusion is relieved.

I offer the following explanation of these phenomena: Teeth that become mobile under the stress of traumatic occlusion are by that fact able to "give" under occlusal pressure, remain symptomless themselves, while suffering periodontal damage. On the other hand, when the alveolar bone has sufficient strength to resist resorptive force, the tooth remains firm and free from periodontal disease. But the shock of traumatic stress nevertheless is felt, this time in the tooth itself, that is, the pulp. The mechanism apparently is the production of a disturbance centering at the tooth apex, affecting the pulpal circulation and nerve supply, with resulting of symptoms of hypersensitivity to cold. Consideration of this etiology would guide the periodontist in such cases to give attention to the occlusion, usually the only attention needed.

John Oppie McCall, D.D.S., 262 Fairhaven Mall, Jericho, N. Y.

*Hypersensitive Teeth: Effect of Strontium Chloride in a Compatible Dentifrice.

**Formalin applied in full strength to the sensitive spot and dried in with warm air; also highly diluted as a constituent of a toothpaste.

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